National Aeronautics and
Space Administration

NSTS 08117
REVISION L
DECEMBER 13, 1995

Lyndon B. Johnson Space Center
Houston, Texas 77058

SPACE SHUTTLE

REQUIREMENTS AND PROCEDURES FOR CERTIFICATION OF FLIGHT READINESS

REVISION LOG

REV LTR	CHANGE NO	DESCRIPTION	DATE
		BASIC ISSUE (Reference SSPM Directive No. 70, dated 10/12/76)	10/21/76
A	1	REVISION A (Reference: Level II PRCBD S04315)	05/17/78
B	5	REVISION B (Reference: Level II PRCBD S14537, dated 11/20/80) also includes PRCBD S14339 and Changes 2 thru 4.	12/19/80
C	10	REVISION C (Reference: Level II PRCBD S23819AR2, dated 9/5/84) also includes Changes 6 thru 9.	09/05/84
D	12	REVISION D (Reference: Level II PRCBD S40129, dated 7/23/86) also includes Change 11.	08/18/86
E	13	REVISION E (Reference: Level II PRCBD S23819ER1, dated 3/24/88) also includes PRCBDs S40465R1 and S40481.	05/02/88
F	19	REVISION F (Reference: Level II PRCBD S063819D, dated 3/28/90) also includes PRCBD S063819K and Changes 14 thru 18.	04/23/90
G	29	REVISION G (Reference: Space Shuttle PRCBD S052600, dated 6/2/92) also includes PRCBD S052600A, CAR S052600A and Changes 20 thru 28.	06/18/92
H	34	REVISION H (Reference: SSP DOC–141, dated 9/24/93) also includes Space Shuttle PRCBDs S052600E, S052730A, S063819Q and Changes 30 thru 33.	10/28/93
J	37	REVISION J (Reference: S052600KR1, dated 2/7/95) also includes Space Shuttle PRCBD S071024BT, CAR S052600KR1, SSP DOC–197, SSP DOC–232 and Changes 35 and 36.	02/21/95
K	39	REVISION K (Reference: Space Shuttle PRCBD S052600M, dated 7/5/95) also includes CAR S052600M and Change 38.	07/07/95
L	40	REVISION L (Reference: Space Shuttle PRCBD S052600N, dated 12/9/95) also includes PRCBD S071024CD.	12/13/95

CHANGE SHEET

FOR

NSTS 08117 – Space Shuttle
Requirements and Procedures for
Certification of Flight Readiness

CHANGE NO. 63

Program Requirements Control Board Directive No. S061580/(2–1), dated 1/4/01.(1)

January 22, 2001

Robert H. Heselmeyer
Secretary, Program Requirements
Control Board

CHANGE INSTRUCTIONS

1. Remove the following listed pages and replace with the same numbered attached pages:

Page	PRCBD No.
8–3 – 8–5	S061580
8–6	
8–27	
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NOTE: A black bar in the margin indicates the information that was changed.

2. Remove the List of Effective Pages, dated September 19, 2000 and replace with List of Effective Pages, dated January 22, 2001.

3. Sign and date this page in the space provided below to show that the changes have been incorporated and file immediately behind the List of Effective Pages.

_____________________________________ __________

Signature of person incorporating changes Date

NSTS 08117 – Space Shuttle
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Certification of Flight Readiness

*Revision L (Reference PRCBD Nos. S052600N, dated 12/9/95 and S071024CD, dated 8/25/95)

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The current status of all pages in this document is as shown below:

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vi – vii	62	S063819AD	August 25, 2000
viii	Rev. L	*	December 13, 1995
1–1	53	S053983BW	September 8, 1998
1–2	54	S063689EH	October 13, 1998
1–3	Rev. L	*	December 13, 1995
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J–2	Rev. L	*	December 13, 1995
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J–4	Rev. L	*	December 13, 1995
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J–6	Rev. L	*	December 13, 1995
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NSTS 08117

SPACE SHUTTLE

REQUIREMENTS AND PROCEDURES FOR CERTIFICATION OF FLIGHT READINESS

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FOREWORD

Efficient management of the Space Shuttle Program (SSP) dictates that effective control of program activities be established. Requirements, directives, procedures, interface agreements, and system capabilities shall be documented, baselined, and subsequently controlled by SSP management.

Program requirements controlled by the Manager, Space Shuttle Program, are documented in, attached to, or referenced from Volumes I through XVIII of NSTS 07700. NSTS 08117, Requirements and Procedures for Certification of Flight Readiness Requirements, establishes a standard approach to be used jointly by contractors and NASA to incrementally review flight preparation of the Space Shuttle Vehicle (SSV). The requirements and procedures herein provide a means for assuring a uniform flight readiness assessment of all SSV elements.

All elements of the SSP must adhere to these baselined requirements. When it is considered by the Space Shuttle Program/Project Managers to be in the best interest of the SSP to change, waive, or deviate from these requirements, an SSP Change Request (CR) shall be submitted to the Program Requirements Control Board (PRCB) Secretary. The CR must include a complete description of the change, waiver, or deviation and the rationale to justify its consideration. All such requests will be processed in accordance with NSTS 07700, Volume IV, and dispositioned by the Manager, Space Shuttle Program, on a Space Shuttle PRCB Directive (PRCBD).

Loren J. Shriver
Manager, Launch Integration, KSC

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CONTENTS

APPENDICES

FIGURES

NSTS 08117

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to define the Space Shuttle Program (SSP) Flight Preparation Process (FPP). It defines the procedures for the Project Milestone Reviews, the Program Milestone Reviews and the Flight Readiness Review (FRR). It also defines the endorsement documentation required at the completion of the FRR which provides the Certification of Flight Readiness (CoFR) for a specific flight.

1.2 SCOPE

This document is applicable to JSC, KSC, MSFC, Stennis Space Center (SSC), and SSP NASA and contractor organizations and personnel involved in the conduct of Space Shuttle operations. The FPP consists of the required preparations for a Space Shuttle mission, from the baselining of the processing requirements to acceptance of the major hardware elements through processing, mating, launch, and ferry when required. The major elements of the FPP are the Project Milestone Reviews, three Program Milestone Reviews, and the FRR where the CoFR endorsement is signed. Reviews of the activities that support the FPP are considered part of the CoFR process.

This Revision L identifies the processes and requirements for all milestone reviews and the FRR for STS–78 and subsequent flights. Revision K applies to prior flights.

1.3 PROCESS DESCRIPTION

The FPP is structured to baseline a set of processing requirements through a series of requirements reviews and to incrementally review and status progress towards readiness for flight (reference Figure 1). It represents a commitment by each of the SSP element and project managers (NASA and contractor) certifying that their organizations have satisfactorily completed the requirements and their respective portions of the effort required to safely support each flight. The FPP is incrementally implemented through milestone reviews and an FRR which ensures the readiness of all organizations for the operational phase following each review. The FPP consists of Project Milestone Reviews, three Program Milestone Reviews and the FRR. The Project Milestone Reviews are the DD 250/1149–Element Acceptance Reviews, the Payload Readiness Review (PRR), the Software Readiness Review (SRR), and the organizational Pre–FRR Reviews. The three Program Milestone Reviews are the Pre–Mate Milestone Reviews, consisting of the External Tank (ET)/Solid Rocket Booster (SRB) Mate Milestone Review and the Orbiter Rollout/ET Mate Milestone Review, and a Ferry Flight Readiness Milestone Review which is conducted when a ferry is required. The CoFR endorsement is signed at the FRR. A Prelaunch Mission Management Team (PMMT) Review will be conducted on the Launch Minus Two (L–2) Day or Launch

Minus One (L–1) Day when the Mission Management Team (MMT) is activated to status the launch countdown and address any issues remaining from the FRR (reference Figure 2). (Reference NSTS 07700 Volume III, Flight Definition and Requirements Directive; NSTS 07700, Volume IV, Configuration Management Requirements; and NSTS 07700, Volume VIII, Operations, Appendix D.)

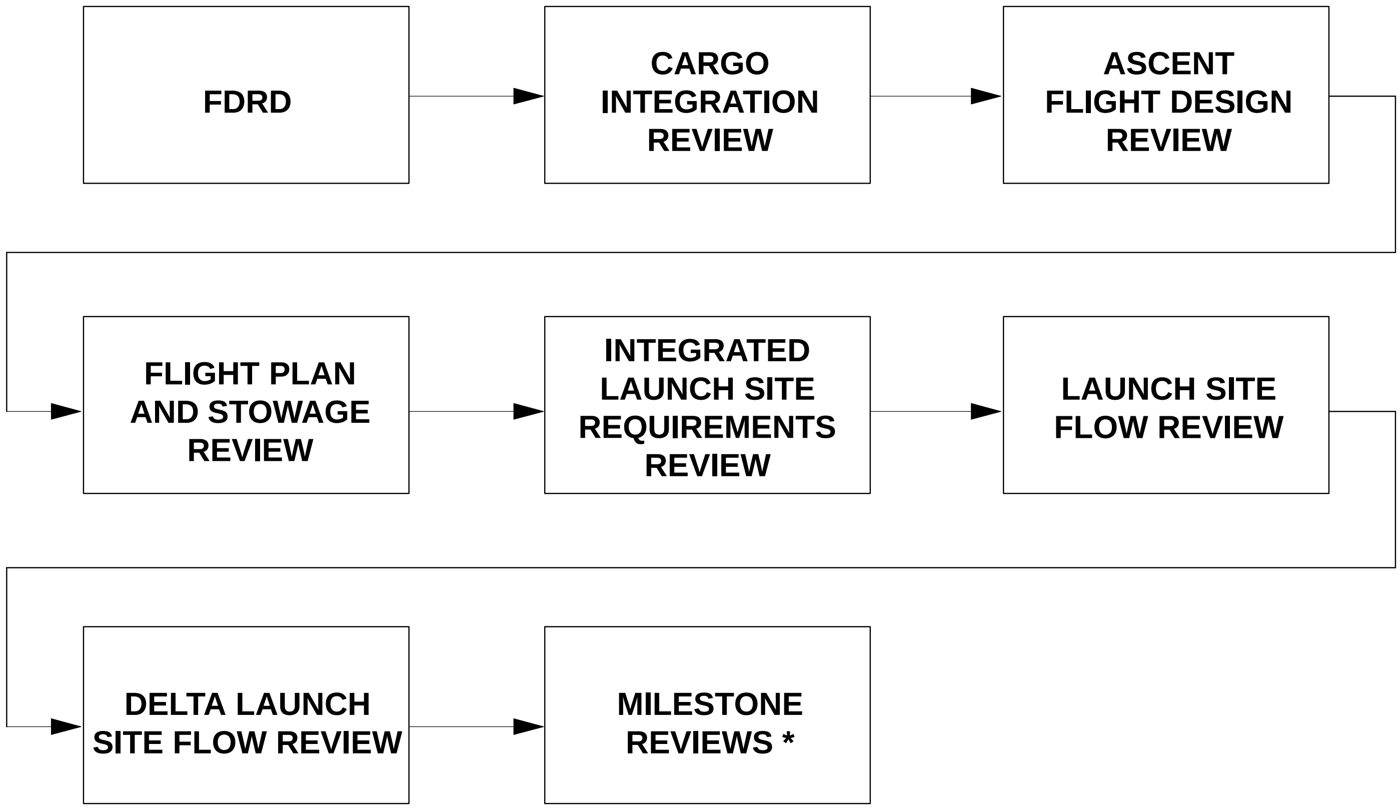
1.4 RESPONSIBILITIES

The Manager, Launch Integration shall manage the FPP. SSP organizations and their respective contractors are responsible for implementing the FPPs as outlined in the appendices of this document. The implementation will be done by certifying that the required work under their purview, as defined in the Flight Preparation Process Plans (FPPPs) for each certifying organization, has been satisfactorily completed and will safely support the specified flight.

The review secretariat function for Program Milestone Reviews and the FRR shall be the responsibility of the Space Flight Operations Contract (SFOC) Program Integration Office at KSC. The secretariat function for the Project Milestone Reviews, shall be the responsibility of the review Chair.

FIGURE 1

FLIGHT PREPARATION PROCESS

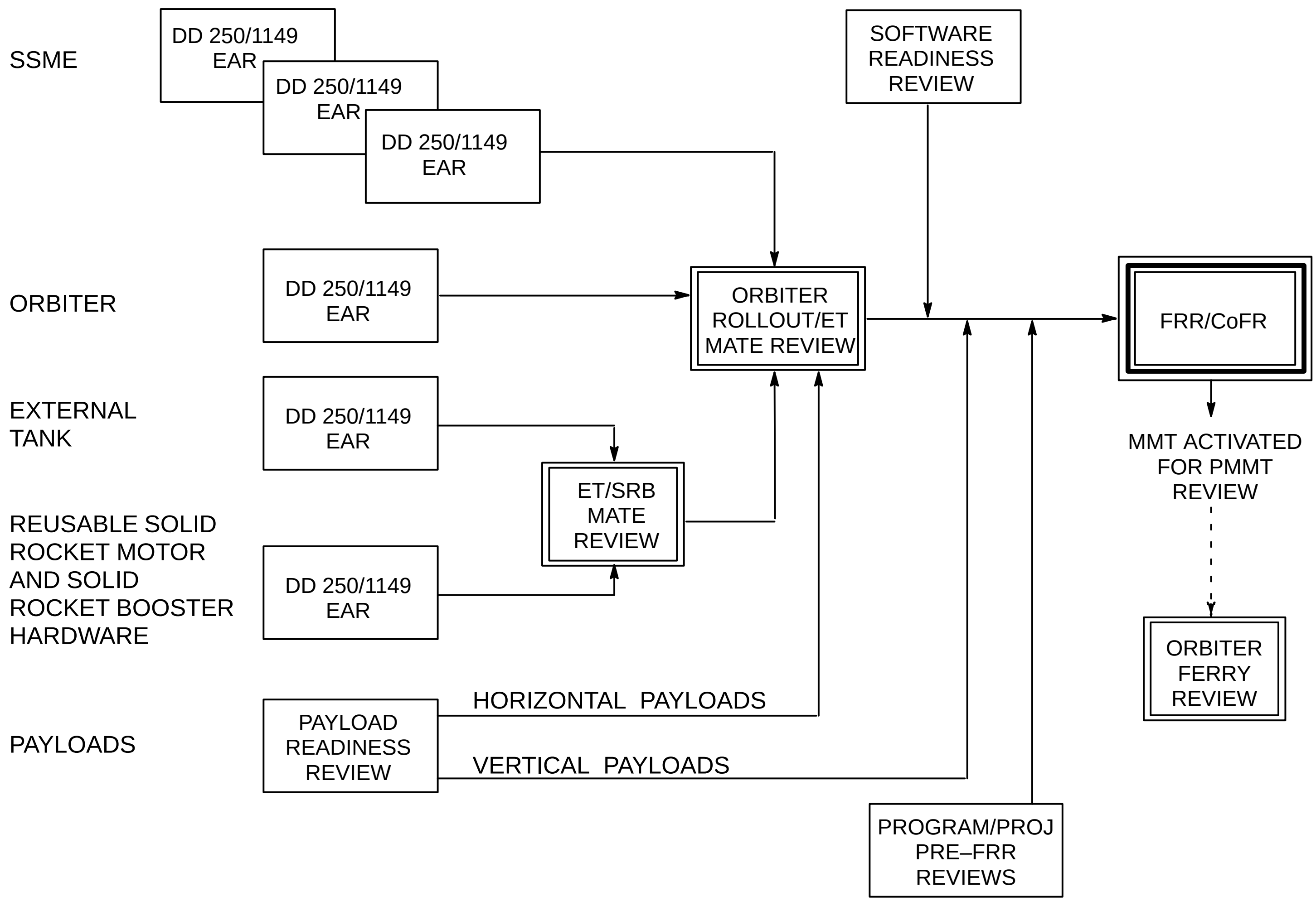


***NOTE: See Figure 2 for expansion.**

NOTE: For specific timeline information, see JSC 25187, Flight Production Generic Template, Appendix A.

FIGURE 2

MILESTONE REVIEWS PROCESS



LEGEND: EAR = ELEMENT ACCEPTANCE REVIEW
FRR = FLIGHT READINESS REVIEW
- - - - = AS REQUIRED
= PROJECT MILESTONE REVIEWS
= PROGRAM MILESTONE REVIEWS
= FRR/CERTIFICATION of FLIGHT READINESS (CoFR)

2.0 APPLICABLE DOCUMENTS

The following documents of the date and issue shown form a part of this document to the extent specified herein. “(Current Issue)” is shown in place of a specific date and issue when the document is under Space Shuttle PRCB control. The current status of documents shown with “(Current Issue)” may be determined from NSTS 08102, Program Document Description and Status Report.

NSTS 07700 (Current Issue)	Program Definition and Requirements Baseline Ref. Foreword, Apx. M
NSTS 07700, Volume I (Current Issue)	Program Description and Requirements Baseline Ref. Apx. I
NSTS 07700, Volume III (Current Issue)	Flight Definition and Requirements Directive Ref. Para. 8.5.14.2, Apx. N
NSTS 07700, Volume IV (Current Issue)	Configuration Management Requirements Ref. Foreword, Para. 1.3, Apx. C, D, E, L, N
NSTS 07700, Volume V (Current Issue)	Information Management Requirements Ref. Apx. D
NSTS 07700, Volume VI (Current Issue)	Flight Support Equipment (FSE) Management Ref. Apx. A, B, O

NSTS 07700, Volume VIII (Current Issue)	Operations
	Ref. Para. 1.3, 8.4, 8.7, Apx. A, D, G, P, Fig. P–1
NSTS 07700, Volume X (Current Issue)	Space Shuttle Flight and Ground System Specification
	Ref. Apx. O
NSTS 07700, Volume X – Book 3 (Current Issue)	Space Shuttle Flight and Ground System Specification, Requirements for Runways and Navigation Aids
	Ref. Apx. H
NSTS 07700, Volume XI (Current Issue)	System Integrity Assurance Program Plan
	Ref. Apx. A
NSTS 07700, Volume XII (Current Issue)	Integrated Logistics Requirements
	Ref. Apx. I
NSTS 07700, Volume XIV	Space Shuttle System Payload Accommodations
	Ref. Apx. N, Apx. R
NSTS 07700–10– MVP–01 (Current Issue)	Shuttle Master Verification Plan, Volume I, General Approach and Guidelines
	Ref. Apx. A, B

NSTS 1700.7	Safety Policy and Requirements for Payloads Using the Space Transportation System Ref. Apx. A, B
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System Ref. Apx. N
NSTS 08126 (Current Issue)	Problem Reporting and Corrective Action (PRACA) System Requirements Ref. Apx. A, D, R
NSTS 08171	Operations and Maintenance Requirements and Specifications Document Ref. Para. 8.5.2.2, 8.5.12.2, 8.5.18.2, Apx. A, B, C, D, E, F, H, J, L, M, N, O
NSTS 08171, File II	Operations and Maintenance Requirements and Specifications Document Ref. Para. 8.5.12.1c, 8.5.12.2, 8.5.14.2, Apx. H, L, M, N
NSTS 08171, Files III, IV, and IX	Operations and Maintenance Requirements and Specifications Document Ref. Para. 8.5.1.2, 8.5.12.1c; Apx. A, L
NSTS 08171, File VI,	Operations and Maintenance Requirements and Specifications Document Ref. Apx. H
NSTS 08171, File VII and VIII	Operations and Maintenance Requirements and Specifications Document Ref. Para 8.5.12.1c; Apx. L

NSTS 08203 (Current Issue)	Technical Operating Procedures (TOPs) Review Implementation Plan Ref. Apx. A
NSTS 08271	Flight and Ground Software Verification and Validation Requirements Ref. Apx. A, R
NSTS 08329 Volume VIII (Current Issue)	DOLILU II Definition and Requirements Document, DOLILU Operations Support Plan Ref. Para. 8.5.13.1d; Apx. M, R
JSC 08338	Orbiter Avionics Mass Memory Unit Computer Program Integration Plan Ref. Apx. A, G, R
NSTS 08349 (Current Issue)	System Integration Plan for Integrated Mission Support Plan Ref. Apx. M
NSTS 08934	Space Shuttle Operational Data Book Ref. Apx. R
NSTS 08934 Volumes V and VII	Space Shuttle Operational Data Book, Orbiter Flight Capability, Orbiter Ascent Structure Envelopes Ref. Apx. A
JSC 08969	Crew Procedures Management Plan (CPMP) Ref. Apx. G, N, Fig. N–1

JSC 09604	Material Selection List for Space Hardware Systems Ref. Apx. A, B
NSTS 11091	Operational Bioinstrumentation System Program Requirements Document Ref. Apx. O
NSTS 12820 Volumes I and II	Space Shuttle Operational Flight Rules, All Flights Ref. Para. 8.5.7.2, Apx. G
NSTS/ISS 13830	Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station Ref. Apx. N
JSC 13956	Medical Operations Requirements Document Ref. Apx. O
NSTS 16007 (Current Issue)	Shuttle Launch Commit Criteria and Background Document Ref. Para. 8.5.7.2, 8.5.12.2, Apx. A, D, G, L, N
JSC 16259	Medications and Bandage Kit Pre–Installation Acceptance Testing Ref. Apx. O
JSC 16260	Emergency Medical Kit Pre–Installation Acceptance Testing Ref. Apx. O

JSC 16299	Medical Operations Support Implementation Plan – White Sands Space Harbor Ref. Apx. O
NSTS 16725	Flight Test and Supplementary Objectives Document (FTSOD) Ref. Para. 8.5.14.2
JSC 16785	Medical Operations Readiness Review Plan Ref. Apx. O
JSC 16888	Microbial Contamination Control Plan Ref. Apx. O
JSC 17038	SSP Flight Equipment Non–Critical Hardware Program Requirement Document Ref. Apx. A, B, O
NSTS 17462–(XX) (As issued for each mission)	Flight Requirements Document (FRD) – STS–XX Ref. Para. 8.5.13.2, Apx. A
NSTS 17481 Revision A September 1984	JSC Safety Requirements Document for Space Shuttle Flight Equipment Ref. Apx. A
JSC 17768	Payload Equipment Landing Site Dispositioning Manual Ref. Apx. B

JSC 18288	Medical Operations Support Implementation Plan – Dryden Flight Research Center Ref. Apx. O
NSTS 18297C	STA Flight Session Plan, Mission–Specific Training Series Ref. Apx. K
NSTS 21000–IDD–ISS	Shuttle Orbiter/International Space Station Interface Definition Document Ref. Apx. R
NSTS 21000–IDD–MDK	Shuttle/Payload Interface Definition Document for Middeck Accommodations Ref. Apx. R
NSTS 21000–IDD–SML	Shuttle/Payload Interface Definition Document for Small Payload Accommodations Ref. Apx. R
NSTS 18308	Space Shuttle Operational Flight Rules, Annex Ref. Para. 8.5.7.2, Apx. G
JSC 20432	SOMS Post–Flight Handling Document Ref. Apx. O
JSC 20483	Human Research, Policy and Procedures for Space Flight and Related Investigations Ref. Apx. O

NSTS 21096	Program Requirements Documents, DTO/DSO Non–Critical Hardware Ref. Apx. A, B, O
NSTS 22206 (Current Issue)	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) Ref. Apx. A
NSTS 22254 (Current Issue)	Methodology for Conduct of Space Shuttle Program Hazard Analyses Ref. Apx. A
JSC 22320	Flight Software Class 1 Integration Plan Ref. Apx. A, R
JSC 22359	SSP Crew Training Ref. Apx. R
JSC 22439	Operational Bioinstrumentation System Failure Modes and Effects Analysis Ref. Apx. O
JSC 22530	Flight Software Reconfiguration Performance Test Plan Ref. Apx. G, R
JSC 22538	Health Stabilization Program for Space Shuttle Program Ref. Apx. O

NSTS 22648	Flammability Configuration Analysis for Spacecraft Applications Ref. Apx. A, B
NSTS 22778	Commit–to–Flight Assessment Review Process Operating Plan Ref. Apx. Q
JSC 22806	Resuscitator Assembly and Patient/Rescuer Restraint System Specifications and Assembly Drawing Ref. Apx. O
JSC 22807	EMK/MBK/MAK Specifications and Assembly Drawing Ref. Apx. O

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JSC 22809	Resuscitator Assembly Program Requirements Drawing Ref. Apx. O
JSC 22810	Contamination Cleanup Kit Specifications and Assembly Drawing Ref. Apx. O
JSC 22811	Resuscitator Pre–Installation Acceptance Testing Ref. Apx. O
JSC 22818	Operational Bioinstrumentation System Specifications and Assembly Drawing Ref. Apx. O
JSC 22837	Contamination Cleanup Kit Pre–Installation Acceptance Testing Ref. Apx. O
JSC 22944	Medical Operations Support Implementation Plan – Ben Guerir, Moracco Ref. Apx. O
JSC 22945	Medical Operations Support Implementation Plan – Moron, Spain Ref. Apx. O
JSC 22946	Medical Operations Support Implementation Plan – Zaragoza, Spain Ref. Apx. O

JSC 22947	Medical Operations Support Implementation Plan – Banjul, The Gambia Ref. Apx. O
JSC 23056	Preflight Preparation and Shipping Procedures for Shuttle Orbiter Medical System Ref. Apx. O
JSC 24397	Payload Equipment Landing Site Disposition Manual and Mission Unique Delay Document Ref. Apx. R
JSC 24734	Medical Operations Shuttle Orbiter Medical System Processing Document Ref. Apx. A, B, O
JSC 24954	Flight Software Build Specification ICD Ref. Apx. A, G, R
JSC 25187	Flight Production Generic Template Ref. Fig. 1
JSC 25220	Airway Medical Accessory Kit Pre–Installation Acceptance Testing Ref. Apx. O
JSC 25268	Medical Extended Duration Orbiter Pre–Installation Acceptance Testing Ref. Apx. O
JSC 25392	Flight Software Test and Operations Plan Ref. Apx. A, R

JSC 25607	Requirements for Submission of Test Sample Materials Data for Shuttle Payload Safety Evaluations Ref. Apx. N, Fig. N–1
JSC 25784	Contamination Cleanup Kit Program Requirements Document Ref. Apx. O
JSC 25863	Fracture Control Plan for JSC Flight Hardware Ref. Apx. A, B
JSC 25990	PRD for Payload Class ‘D’ Hardware Ref. Apx. A, B
JSC 26287	Project Management Plan (PMP) Guideline Ref. Para. 9.0
JSC 26546	Medical Operations Flight Support Training and Certification Plan Ref. Apx. O
JSC 61100	Project Management Guide Ref. Para. 9.0, Apx. A, B, O
EE2–91–011/XX	Camcorder System Assembly Kit Stowage Document Ref. Para. 8.5.18.2, Apx. A, B

FEMU–R–001	(EMU PRD) Ref. Apx. B
FR–19678	Pratt & Whitney Configuration Management Plan Ref. Apx. C
ICD–2–19001	Shuttle Orbiter/Cargo Standard Interface Control Document Ref. Para. 8.5.13.1, 8.5.18.2, Apx. M
JSC MD 1152.9A	JSC Radiation Constraints Panel Ref. Apx. A, B, O
JSCM 5312Q	Quality Assurance Manual Ref. Apx. A, B
JSCM 5312, QAI–12	Quality Manual Ref. Apx. A, B
JSCM 8080	JSC Design and Procedural Standards Manual Ref. Apx. A, B
JSCM 8500	Engineering Drawing System Manual (B–35) Ref. Apx. A, B, O
K–STSM–12.5.04	KSC Ground Operations Training Plan for Space Shuttle Operation Ref. Apx. K

KBM–PL–1.1A	Emergency Medical Services Plan – Kennedy Space Center Ref. Apx. O
KPD 8630.3	KSC Shuttle Processing Flight Readiness/ Certification Review Plan Ref. Apx. H
KVE–PL–0007	STS and Cargo LCC Implementation Plan Ref. Apx. H, J
MMC–ET–CM01	Configuration Management Plan Ref. Apx. D
MMC–ET–CM02	End Item Specification (CPT01M09A) Ref. Apx. D
MMC–ET–CM06	Documentation Changes and Revisions Ref. Apx. D

MMC–ET–RA01b	External Tank Hazard Analysis Report Ref. Apx. D
MMC–ET–RA03	Quality, Reliability, and Safety Requirements and Implementation Document Ref. Apx. D
MMC–ET–RA04b	Critical Items List Ref. Apx. D
MMC–ET–RA06	Space Shuttle External Tank Criticality 1, 1R, 2 and 2R Problem Reporting Requirement Plan Ref. Apx. D
MMC–ET–RA07	NASA ALERT System Documentation Ref. Apx. D
MMC–ET–RA10	End Item Acceptance Data Package Ref. Apx. D
MMC–ET–SE16	Materials and Processes Control Plan Ref. Apx. D
MMC–ET–SE42	ET Long Term Storage Requirements Ref. Apx. D
MMC–ET–TM01	External Tank Verification Plan Ref. Apx. D

MMC–ET–TM04k	Acceptance Test; Storage and Pre–Shipment Test and Specification Requirements Ref. Apx. D
MMC–ET–TM06	Certification and Qualification Ref. Apx. D
MMC–ET–TM08	Hardware Certification Sheet Ref. Apx. D
MMC–ET–TM09	ET Verification Program Status Report Ref. Apx. D
MSFC–HDBK–527	Material Selection List for Space Hardware Systems Ref. Apx. A, B
NASA SP–8013	Meteoroid Environment Model (Near Earth to Lunar Surface) Ref. Apx. O
NHB 8060.1C	Test 1 Ref. Apx. B
NHB 8071.1	Fracture Control Requirements for Payload Using the National Space Transportation System (NSTS) Ref. Apx. A, B

NMI 8610.10B	Management of Operational Support Requirements for Manned Flight Missions Ref. Para. 9.0
PDP MS–002	Element Avionics Systems Integration Ref. Apx. R
PDP MS2–001	Payload/Cargo Structural Analysis Ref. Apx. R
PDP MS2–002	Active and Passive Thermal/ECLSS Verification Analysis Ref. Apx. R
PDP MS2–003	Payload/System Engineering Products EME Ref. Apx. R
PDP MS3–001	Payload Engineering Products Shuttle to Payload Interface Requirements Ref. Apx. R
PDP MS3–002	Reconfiguration Engineering Ref. Apx. R
PDP MS3–003	Cargo Safety Ref. Apx. R
PDP MS3–004	Cargo Hardware Design and Development Ref. Apx. R

PDP MS3–006	Systems Safety Ref. Apx. R
PDP MS3–007	Payload Engineering Products – Payload Unique Interface Requirements Ref. Apx. R
PDP MS3–008	Payload Data Package – Annex 1 Ref. Apx. R
PDP MS3–009	Payload Engineering Products – OMRSD Ref. Apx. R
PDP MS3–010	Payload Engineering Products – ICD Compatibility Assessments Ref. Apx. R
PDP MS3–013	Space Shuttle Program Systems ICDs, Product Development Plan Ref. Apx. R
PDP MS4–002	Flight Systems Analysis Ref. Apx. R
PDP MS8–003	KSC Requirements and Maintenance Ref. Apx. R
PDP MS8–005	Program Integration Certification of Flight Readiness Product Development Plan Ref. Apx. R

PDP 3.2–MV–FRR (DRAFT)	Product Development Plan for Orbiter Flight Readiness Ref. Apx. A, R
PDP 6.8–MV–FSW FRR	Flight Software Flight Readiness (Preliminary) Ref. Apx. R
RSOC86 March 7, 1987	Flight Operations Integration Group, Flight Techniques, and Flight Rules Documentation Procedures Handbook Ref. Apx. G
RSOC86–0046 Revision E	Crew Training Catalog Ref. Apx. G, K
RSS–8503–3	Rocketdyne Configuration Management Plan Ref. Apx. C
SE–R–0006 (Current Issue)	General Specification Space Shuttle System Requirements for Materials and Processes Ref. Apx. A, B
SE–S–0073 (Current Issue)	Specification, Fluid Procurement and Use Control Ref. Apx. O
SFOC–FLO–389	SFOC/Flight Operations CoFR/Flight Preparation Process Plan Ref. Apx. R

SFOC–PA–0007	Safety and Mission Assurance Flight Preparation Processing Plan Ref. Apx. R
SFOC–PASS–001	Space Shuttle Orbiter Avionics Quality Assurance Plan Ref. Apx. A, R
SFOC–PASS–002	Space Shuttle Orbiter Avionics Software Management Plan Ref. Apx. A, R
SFOC–96–055	SFOC Ground Operations Flight Preparation Process Plan Ref. Apx. R
SN3–R51	Final Assembly Procedures for the Passive Radiation Dosimeter (PRD) P/N SED 33102690–301 Ref. Apx. O
SN3–R52	Final Assembly Procedures for the Crew Passive Dosimeter (CPD) P/N SED 11100212–301 Ref. Apx. O
SN3–R53	Final Assembly Procedures for the Radiation Dosimeter Assembly P/N SED 33103036–301 Ref. Apx. O
STSOC–TG–001230A January 1995	Flight Operations Support Personnel Training Guide Annex, Flight Controller Training Objectives Ref. Apx. G

SW–E–0002 (Current Issue)	Space Shuttle Ground Support Equipment General Design Requirements Ref. Apx. A, B
TWR–10150	Thiokol Configuration Management Plan Ref. Apx. E

3.0 MILESTONE AND FRR REVIEW ACTIONS

Actions may be assigned at the milestone reviews and the FRR by the Chair of the specific review. Actions identified as constraints to the milestone must be dispositioned prior to that milestone. Actions identified at the Project Milestone Reviews will be tracked and closed out by the Chair of the specific review. Actions identified at the Program Milestone Reviews will be program action items, and will be tracked until closure by the review secretariat. A periodic status will be provided to the Manager, Launch Integration, and all closure rationale will be dispositioned by the Manager, Launch Integration.

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4.0 DOCUMENTATION REQUIREMENTS

The Project Milestone Reviews and organizational Pre–FRR proceedings will be documented in a manner to adequately reconstruct deliberations. The following items are applicable to the Program Milestone Reviews and the FRR:

a. Review Minutes – Review minutes will be prepared by the review secretariat which will contain the following as applicable:

    1. Significant items of discussion/special topics

    2. Presenter's names and mailcodes

    3. Agenda

    4. Action Item Log (if any)

    5. Exception Log (FRR only, if any)

b. Recordings – Audio recordings of all Program Milestone Reviews will be accomplished. The FRR will be audio and video recorded. Recording tapes (audio and video) will be included as part of the record.

c. Presentations – All milestone review presentations will utilize an electronic format. Viewgraphs will be used for multiple screen presentations. The presenters are responsible for submitting presentation material electronically by the date and time specified in the review announcement letter. The review secretariat is responsible for assuring there are adequate paper copies of the presentation material for the reviewing officials.

4.1 DEPOSITORY REQUIREMENTS

The SFOC Contractor, Program Integration, KSC, shall maintain the document depository for all Program Milestone Reviews and the FRR. The Space Shuttle Launch Integration Office (KSC) shall compile the review action item forms, review action item log forms, audio recordings, sign–in rosters, presentation material and minutes from the Program Milestone Reviews. For the FRR, a seating chart, polling list, endorsement, exception forms, an exception log, review action item forms, review action item log form, letters of delegation, recordings, sign–in rosters, presentation material and minutes will be compiled and become part of the permanent program file.

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5.0 PROCEDURES

a. Single Point of Contact – The Manager, Launch Integration, will coordinate Program Milestone Reviews and FRR planning through the Space Shuttle Launch Integration Office (KSC).

b. Announcement Letter – Approximately one week (two weeks for the FRR) prior to the Program Milestone Reviews, an announcement letter will be issued by the Manager, Launch Integration, establishing the review date and any special requirements.

c. Location – All Program Milestone Reviews will be by teleconference. The FRR will be a face–to–face meeting at KSC.

d. Documentation – The review secretariat will prepare the formal documentation of the proceedings.

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6.0 PROJECT MILESTONE REVIEWS

The FPP includes multiple Project Milestone Reviews. The DD 250/1149–Element Acceptance Reviews are chaired by the Program/Project Managers or TMRS as appropriate, as defined in Paragraph 6.1. The PRR is co–chaired by the Manager, Space Shuttle Customer and Flight Integration Office and the KSC Director of Payload Operations, as defined in Paragraph 6.2, and is held prior to the Orbiter Rollout/ET Mate Milestone Review for horizontally installed payloads, or prior to payload transfer to the launch pad for vertically installed payloads. The SRR is held prior to the mission FRR, as defined in Paragraph 6.3. The organizational Pre–FRRs are held by each program/project prior to the mission FRR, as defined in Paragraph 8.3. Other reviews are also considered part of the FPP and are referenced in Figure 1.

6.1 ELEMENT ACCEPTANCE REVIEW PROCESSES

Element Acceptance Reviews certify that an element/component/kit has been delivered according to specifications. There are two types of element acceptance reviews used by the Space Shuttle Program:

a. Reviews for hardware provided as government furnished property

b. Reviews for hardware provided as contractor furnished property

6.1.1 Element Acceptance Reviews for Hardware Provided as Government Furnished Property

These reviews use the DD 250/1149 process during hardware acceptance. The elements currently required to conduct the DD 250/1149 – Element Acceptance Review are the ET, Space Shuttle Main Engine (SSME), Reusable Solid Rocket Motor (RSRM) segments (forward, forward center, aft center, and aft), and Solid Rocket Booster (SRB) (DD 1149 only [aft skirt assemblies, aft booster assembly kits, forward assemblies, and integrated assembly kits]). The RSRM segment DD 250s are signed twice, first to approve transportation to KSC and again at KSC for final acceptance after the receiving inspection is completed.

6.1.1.1 Responsibilities

a. It is the responsibility of the Program/Project Manager to conduct the DD 250/1149 Element Acceptance Review.

b. The Program/Project Managers, or their designated representatives have approving authority.

c. The SFOC is the responsible receiving authority for the acceptance of the hardware.

d. Subsequent to each DD 250/1149 – Element Acceptance Review, the acceptance data package will be relinquished to the SFOC.

6.1.1.2 Review Requirements

In support of the DD 250/1149 – Element Acceptance Reviews, the projects shall ensure accomplishment and closure, as applicable and present a status summary with supporting detail on significant items as detailed below:

a. Departures from specifications and drawings by the Material Review Board (MRB) or by contractual waiver.

b. Departures from specified requirements documents during acceptance checkout.

c. Discrepancies found during acceptance checkout and associated retesting.

d. Resolution of hardware failures and the corrective action implemented or approved.

e. Completion of a Configuration Inspection (CI).

f. Definition and identification of all unplanned/deferred work defined in the Acceptance Data Package, and identification of any impacts to using site.

g. Hazard controls and verification are closed and Critical Items List (CIL) rationale are acceptable.

h. Installation and acceptance of functional Government Furnished Equipment (GFE).

i. Open issues affecting this element(s), (or segment thereof).

6.1.2 Element Acceptance Reviews for Hardware Provided as Contractor Furnished Property

These reviews are conducted to document the completion/delivery of acceptable hardware and the acceptance data package. After the review is complete, the hardware is transferred via contractor transfer documents.

6.1.2.1 Responsibilities

a. It is the responsibility of the Manger, Launch Integration or designated representative to conduct the acceptance review.

b. the review will document completed work/requirements and status of the hardware and acceptance data package.

c. The SFOC is the receiving authority for transfer of the hardware and the acceptance data package.

6.1.2.2 Review Requirements

The review will ensure accomplishment and closure, as applicable, and provide a status summary with supporting detail on significant items as detailed below:

a. Departures from specifications or drawings by the MRB or by contractual waiver.

b. Departures from specified requirements documents during acceptance retesting.

c. Discrepancies found during acceptance checkout and associated retesting.

d. Resolution of hardware failures and the corrective action implemented or approved.

e. Completion of a CI.

f. Definition and identification of all unplanned/deferred work defined in the Acceptance Data Package (ADP), and identification of any impacts to using site.

g. Hazard controls and verification are closed and CIL rationale are acceptable.

h. Installation and acceptance of functional GFE.

i. Open issues affecting this element(s), (or segment thereof).

6.2 PAYLOAD READINESS REVIEW (PRR)

The PRR certifies the payload readiness for Orbiter integration.

6.2.1 Responsibilities

a. The Director of ISS/Payloads Processing and Manager, Space Shuttle Customer and Flight Integration Office, or designated representative, are responsible for co–chairing the PRR prior to payload transfer to the Orbiter Processing Facility (OPF) or pad for Orbiter integration.

b. The Space Shuttle Systems Integration Office will support the PRR to ensure readiness of integration hardware and engineering activities necessary for payload integration into the Orbiter.

c. The ISS/Payloads Processing Directorate, Shuttle Processing Directorate, and customer representatives will develop and support with appropriate personnel applicable briefings to address topics related to readiness for payload/Orbiter integration, including safety and quality readiness.

6.2.2 Review Requirements

a. The Orbiter and payload projects shall ensure accomplishment of those activities necessary to accommodate integration of the payload into the Orbiter, and resolution, as applicable, of any incompatibilities associated with integration.

   In support of the PRR, the appropriate status summaries will be provided, with supporting detail and/or rationale on significant items as detailed below:

   1. Constraints to payload integration into the Orbiter.
   2. Waivers, deviations, and exceptions applicable for payload/Orbiter integration.
   3. Problems, unexplained anomalies, and In–Flight Anomalies (IFAs) applicable to payload/Orbiter integration.
   4. Certification and training of personnel actively participating.
   5. Incorporation of new or revised hardware requirements in Technical Operating Procedures (TOPs).
   6. Time, cycle, age life, interval inspection, and maintenance requirements of flight hardware.
   7. Certification/validation of Ground Support Equipment (GSE) and L&L facilities, hardware, and software.
   8. Approval or disposition of discrepancies for GSE and L&L facilities, hardware and software, for payload/Orbiter integration.
   9. Completion of processing activities, Shuttle and payload, necessary to allow payload integration into the Orbiter.
   10. Payload Ground Integrated Hazard Assessment.

b. The PRR agenda shall include:

1.	Introduction	Director of ISS/Payloads Processing, KSC Manager, Space Shuttle Customer and Flight Integration
2.	Requirements and Documentation Status	Space Shuttle Customer and Flight Integration
3.	Payload Processing Status and Planning	Payload Manager

4.	Shuttle Processing	Shuttle Processing Representative
5.	Payload Status	Payload Customer Representative
6.	Readiness Assessment	Payload Readiness Board

6.3 SOFTWARE READINESS REVIEW (SRR)

The SRR is comprised of four categories:

a. Primary Avionics Software System (PASS)

b. Backup Flight System (BFS)

c. Reconfiguration (RECON) activities

d. Software interfaces

A status of all products applicable to flight are presented as complete or open at this review. The SRR is conducted approximately four weeks prior to flight and is presented to the Manager, Avionics and Software Office.

6.3.1 Responsibilities

a. The Manager, Avionics and Software Office in the Space Shuttle Vehicle Engineering Office (SSVEO), or designated representative, is responsible for conducting the SRR. Upon successful completion of the SRR, a readiness statement shall be signed. The Avionics and Software Office is also responsible for implementing the SRR requirements: Planning and coordinating of meeting and agenda; tracking, coordinating, statusing, and ensuring closeout of waiver/exception items.

b. The JSC Engineering Directorate will support with appropriate personnel to review the applicable briefing content and to status their assessment of the readiness of the PASS and BFS Flight Software (FSW). The assessment will include surveillance of all applicable Change Requests (CRs), Discrepancy Reports (DRs), and verification testing as well as review and concurrence on all assigned new development or out-of-family software issues and changes. In addition, a signed readiness statement shall be provided.

c. The flight software contractor for the PASS and BFS software will develop and support with appropriate personnel their applicable briefing content necessary to status the readiness of the PASS and BFS software. In addition, a signed readiness statement shall be provided.

d. The Mission Operations Directorate (MOD) will support with appropriate personnel to review the applicable briefing content and to status their assessment of the readiness of the RECON activities. The assessment will also include: surveillance of applicable I–Load design and reconfiguration functions; CRs, DRs, and verification testing involving assigned flight software principle functions; and concurrence on all new development or out–of–family software issues and changes. In addition, signed readiness statements shall be provided by responsible MOD organizations.

e. The reconfiguration requirements contractor will develop and support with appropriate personnel their applicable briefing content necessary to status the readiness of the reconfiguration activities, including facility readiness. In addition, a signed readiness statement shall be provided.

f. The SSME Project Office, MSFC, is responsible for development of the presentation material statusing of the SSME Controller (SSMEC) software readiness for flight at the FRR. Any known interface issue(s) at the time of the SRR should be presented as a special topic. If there are no known interface issues, a signed readiness statement shall be provided in support of the SRR.

g. The KSC Integration Office, is responsible for the development of the presentation material statusing the ground systems software readiness for flight at the FRR. Any known interface issue(s) at the time of the SRR, should be presented as a special topic. If there are no known interface issues, a signed readiness statement shall be provided in support of the SRR.

h. The flight software contractors will develop and support with appropriate personnel their applicable briefing content necessary to assess the readiness of the flight software to successfully achieve the flight's goal and objectives within the constraints and limitations of the program requirements. In addition, a signed readiness statement shall be provided. The integration presentations shall occur at the end of all categories to summarize any known issue(s).

i. The Independent Verification and Validation (IV&V) contractor will develop and support with appropriate personnel their applicable briefing content necessary to assess the readiness of the Orbiter flight software. In addition, a signed readiness statement shall be provided. The IV&V presentations will follow the integration presentation and shall summarize any known issue(s).

6.3.2 Review Requirements

a. In support of the SRR, the applicable NASA organizations and their contractors shall ensure accomplishment and completion, with supporting detail, on the following items:

   1. Status of all flight approved Change Request (CR) and Discrepancy Report (DR) changes to the Operational Increment (OI) software.

2. Disposition of all applicable (Severity 1 and 2 or Severity 3 requiring a user note) DRs since the last flight.

3. Status of all applicable DRs against RECON tools, Software Production Facility (SPF) simulators, and High–Order Assembly Language (HAL) compiler.

4. Status of all new waivers, operations notes, and user notes required for flight.

5. Status of verification testing (Shuttle Avionics Integration Laboratory [SAIL] and SPF) planned/completed testing on approved CR and DR changes delivered for use with the OI software.

6. Status of verification configuration and compatibility supporting formal OI and mission testing (SAIL).

7. Summary of any issues resulting from the I-Load audits for flight.

8. Summary of any violation of program requirements.

9. Summary of the Quality Assurance (QA) processes and software risk assessment status.

10. Plan of forward actions to complete Open Work prior to flight.

b. The SRR agenda items and presenting organizations are listed below:

1.	Introduction	Manager, Avionics and Software Office
2.	Primary Avionic Systems Software	APM, Flight Software, SFOC
3.	Backup Flight System Software	APM, Flight Software, SFOC
4.	Reconfiguration	APM, Flight Operations, SFOC
5.	Space Shuttle Main Engine Controller Interface Software	Manager, SSME Project
6.	KSC Ground Systems Interface Software	Manager, KSC Integration Office
7.	Integration	APM, Flight Software, SFOC
8.	SAIL Verification	Manager, Integrated Avionics Verification

9.	IV&V	Manager, IV&V Contractor
10.	Safety, Reliability & Quality Assurance	Manager, SR&QA Space Shuttle Division
11.	Action Item Summary	Manager, Avionics and Software Office

7.0 PROGRAM MILESTONE REVIEWS

7.1 PRE–MATE MILESTONE REVIEWS

The Pre–Mate Milestone Reviews consist of the ET/SRB Mate and Orbiter Rollout/ET Mate Milestone Reviews. These reviews are presented to the Manager, Launch Integration. The reviews will be held approximately one week prior to the milestone.

7.1.1 Responsibilities

a. The Manager, Launch Integration is responsible for conducting the Pre–Mate Milestone Reviews.

b. The Program/Project Managers or their representative will develop their applicable briefing content. Any independent investigation conducted by the projects will be presented as a special topic during their presentation. In addition, they are responsible for assuring the attendance of personnel who are principals, and provide the data necessary to status the readiness of the SSV systems.

c. Shuttle Processing is responsible for the development and presentation of the vehicle processing, status, and readiness of the ground system and facilities.

7.1.2 ET/SRB Mate Milestone Review

The ET/SRB Mate Milestone Review is presented prior to the mate operations. Projects provide a status of the issues identified in the preparation of the ET, RSRM segments, SRB assemblies and kits, and Mobile Launcher Platform (MLP). Status is also provided to ensure the satisfactory closeout of all requirements, exceptions, and the scheduled completion of open actions, work, or documentation.

7.1.2.1 Review Requirements

a. In support of the ET/SRB Mate Milestone Review, the projects shall ensure accomplishment and closure, as applicable, and present a status summary with supporting detail, on significant items, as detailed below:

   1. Open constraints to ET/SRB Mate.

   2. Disposition of waivers, deviations, exceptions, and restricted hardware is acceptable for ET/SRB Mate.

   3. Evaluation and documentation of problems, unexplained anomalies, and IFAs is acceptable for ET/SRB Mate.

4. Certification and training of personnel actively participating.
5. Definition of flight hardware requirements in released engineering and documentation.
6. Incorporation of new or revised flight hardware requirements in TOPs.
7. Implementation of released requirements and engineering of as–built flight element configuration, based on data provided by Space Flight Operations Contractor (SFOC).
8. Scheduled completion of flight hardware certification prior to the FRR.
9. Time, cycle, age life, interval inspection, and maintenance requirements of flight hardware.
10. Approval and release of hardware and software requirements documents for GSE and the L&L facilities.
11. Certification/validation of hardware, software, and failures for ET/SRB Mate of GSE and the L&L facilities.
12. Approval or disposition of discrepancies of hardware, software, and failures for GSE and the L&L facilities, for ET/SRB mate.
13. Implementation of flight and ground requirements, and configuration requirements provided by flight projects in TOPs.
14. Incorporation of all significant differences from previous flights in applicable documents, where required.
15. Closure of all hazards associated with ground operations.

b. The ET/SRB Mate Milestone Review agenda items and presenting organizations are listed below:

1.	Introduction	Manager, Launch Integration KSC Launch Director
2.	External Tank	Manager, ET Project
3.	Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC
4.	RSRM	Manager, RSRM Project
5.	SRB	Manager, SRB Project, APM, SRB Element, SFOC
6.	KSC Integration	Manager, Space Shuttle KSC Integration APM, Program Integration, SFOC

7.	Shuttle Processing	Director of Shuttle Processing, KSC APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
8.	S&MA	Chief, Shuttle Safety and Mission Assurance, KSC Director, Safety and Mission Assurance, MSFC
9.	Action Item Summary	Manager, Launch Integration

7.1.3 Orbiter Rollout/ET Mate Milestone Review

The Orbiter Rollout/ET Mate Milestone Review is presented prior to the Orbiter rollout from the OPF. A status is provided of ET preparations, necessary payload accommodation hardware and payloads integration, and a schedule of planned work necessary for moving the Orbiter to the Vehicle Assembly Building (VAB) for mating with the ET/SRB. Additionally, status is provided to ensure the mated ET/SRB is ready to accept the Orbiter and the VAB, MLP, crawler transporter, and launch pad will be ready to accept and support the SSV (Orbiter, ET, SRB [includes the RSRM], SSME) and payloads; the vehicle and payload checkout and launch software is current and is verified for use in the VAB and at the launch pad; and ensure the satisfactory closeout of requirements, exceptions, and the scheduled completion of open actions, work and documentation.

7.1.3.1 Review Requirements

a. In support of the Orbiter Rollout/ET Mate Milestone Review, the affected elements shall ensure accomplishment and closure, as applicable and present a status summary with supporting detail on significant items as detailed below:

   1. Open constraints to Orbiter Rollout/ET Mate.

   2. Disposition of waivers, deviations, exceptions, and restricted hardware is acceptable for Orbiter Rollout/ET Mate.

   3. Evaluation and documentation of problems, unexplained anomalies, and IFAs is acceptable for Orbiter Rollout/ET Mate.

   4. Certification and training of personnel actively participating.

   5. Definition of flight hardware requirements in released engineering and documentation.

   6. Incorporation of new or revised flight hardware requirements in TOPs.

7. Implementation of released requirements and engineering of as–built flight element configuration, based on data provided by SFOC.
8. Scheduled completion of flight hardware certification prior to the FRR.
9. Time, cycle, age life, interval inspection, and maintenance requirements of flight hardware.
10. Approval and release of hardware and software requirements documents of GSE and the L&L facilities.
11. Certification/validation of hardware and software of GSE and the L&L facilities.
12. Approval or disposition of hardware and software, and failures discrepancies for GSE and the L&L facilities, for Orbiter Rollout/ET Mate.
13. Implementation of flight and ground requirements, and configuration requirements provided by flight projects in TOPs.
14. Incorporation of all significant differences from previous flights in applicable documents, where required.
15. Closure of all hazards associated with ground operations.

b. Orbiter Rollout/ET Mate Milestone Review agenda items and presenting organizations are listed below:

1. Introduction	Manager, Launch Integration KSC Launch Director
2. Program Integration	Flight Manager Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
3. Payload Processing	Director of ISS/Payloads Processing, KSC
4. SSME (as required)	Manager, Space Shuttle Main Engine Project
5. SSME	Rocketdyne Site Director, KSC
6. Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, FCE/EVA, SFOC

7.	EVA	Manager, EVA Project Program Manager, HSSSI
8.	Shuttle Processing	Director of Shuttle Processing, KSC APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
9.	SR&QA	Chief, Shuttle Safety and Mission Assurance, KSC Director, Safety, Reliability and Quality Assurance, JSC Director, Safety and Mission Assurance, MSFC
10.	Action Item Summary	Manager, Launch Integration

7.2 FERRY FLIGHT READINESS MILESTONE REVIEW

The Ferry Flight Readiness Milestone Review will be conducted after the Orbiter has landed (or pre–Orbiter Maintenance Down Period [OMDP] and post–OMDP) approximately one day prior to ferry. The review will ensure the readiness of the Orbiter, payload, and Shuttle Carrier Aircraft (SCA) for ferry. The Ferry Plan will be reviewed and the expected ferry route weather will be briefed by the USAF Air Weather Service. The SCA commander will recommend whether the weather is suitable to meet the appropriate ferry constraints, and the SCA will be released for ferry.

7.2.1 Responsibilities

The Manager, Launch Integration, or designated representative, is responsible for conducting the Ferry Flight Readiness Milestone Review. Further, this responsibility includes planning, coordinating, and implementing the Ferry Flight Readiness Milestone Review requirements and agenda; tracking, coordinating, statusing, and ensuring closeout of action items; and that the SCA, ground support, and documentation is in place to conduct the ferry mission.

7.2.2 Organization

The Ferry Readiness Review Board will be chaired by the Manager, Launch Integration, or a designated representative, and as such will be solely responsible for the decision of readiness for ferry. The board will include as members:

a. Manager, Launch Integration

b. Ferry Manager

c. Director of Shuttle Processing Representative

d. Flight Crew Operations Directorate Representative

e. Space Shuttle Vehicle Engineering Representative

f. Space Shuttle KSC Integration Office Representative

g. Space Shuttle Customer and Flight Integration Representative

h. EVA Project Representative

i. Space Flight Operations Contractor Representative

j. Department of Defense Manned Space Flight Support Office (DDMS)

k. Space Shuttle SR&QA Representative

7.2.3 Review Requirements

a. Presentation Emphasis – The Ferry Flight Readiness Milestone Review will cover SCA readiness and Orbiter mass properties and configuration, SCA and Pathfinder flight crews and manifests, predicted performance, routes and stop–over points, support requirements, payload considerations, hazardous materials and security provisions, Public Affairs Office (PAO) plans, and expected ferry route weather.

b. Schedule – The Ferry Flight Readiness Milestone Review will be conducted the day prior to the planned ferry initiation.

c. Location – The Ferry Flight Readiness Milestone Review will be conducted at the ferry mission origination location and teleconed to other sites as required.

d. In support of the Ferry Flight Readiness Milestone Review, the projects shall ensure accomplishment and closure, as applicable and present a status summary with supporting detail on items listed below:

   1. Open constraints to Orbiter ferry.

   2. Resolution or closure of flight and ground hardware nonconformances, that would affect ferry flight.

   3. Review of and identification of, IFA constraining Orbiter ferry.

   4. Completion of a review of aircraft maintenance records and release of the SCA to support Orbiter ferry.

   5. Completion of post–landing damage assessment.

   6. Incorporation of new or revised flight and ground hardware requirements in TOPs.

7. Incorporation of flight vehicle and ferry flight hardware configuration in released engineering, based on data provided by SFOC.

8. All enroute facilities are ready.

9. Completion or scheduled completion of flight and ground requirement, and configuration requirements, and incorporation in approved TOPs.

e. The agenda items and presenting organizations are listed below:

1.	Introduction	Manager, Launch Integration
2.	Shuttle Processing	Director of Shuttle Processing, KSC APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
3.	Vehicle Engineering Status	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, FCE/EVA, SFOC
4.	EVA	Manager, EVA Project Program Manager, HSSSI
5.	KSC Integration	Manager, Space Shuttle KSC Integration APM, Program Integration, SFOC
6.	Customer and Flight Integration	Manager, Space Shuttle Customer and Flight Integration
7.	Airfield Readiness	DDMS
8.	Flight Operations	Chief, Aircraft Operations
9.	Security	Security Officer
10.	Weather	USAF Air Weather Service
11.	Summary, Action Items	Manager, Launch Integration
12.	Readiness Poll	Manager, Launch Integration

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8.0 FLIGHT READINESS REVIEW (FRR)

Approximately two weeks prior to launch, a FRR will be conducted that will determine the readiness of the SSV, flight crew, and payloads. At the review, organizations identified in Paragraph 8.7b will certify the completion of all tasks and planned work required to prepare the flight/ground hardware/software, support facilities, and operations personnel to safely support a specific mission. Readiness for flight shall be determined through the review of necessary data to ensure satisfactory closeout of all FRR certification requirements, exceptions, and launch constraints, and be in sufficient detail to provide the Director, Space Shuttle Program Lead Center with the information needed to make a decision as to flight readiness.

8.1 POLICY

The FRR is an integrated senior management review chaired by the Director, Space Shuttle Program Lead Center who is supported by a review board. It is the policy of the Director, Space Shuttle Program Lead Center to make an assessment of mission readiness prior to each flight. This will be accomplished by a comprehensive review of all activities/elements necessary for the safe and successful conduct of all operations from prelaunch through post–landing and recovery operations. Government and contractor representatives will certify readiness in their areas of responsibility.

8.2 CERTIFICATION REQUIREMENTS

The CoFR endorsement certifies all organizations (NASA and contractor) have successfully completed their FPPs and products per their Flight Preparation Process Plans (FPPPs). During the transition period for the SFOC contract the transition plans and PDPs document the transfer of responsibilities from NASA to the contractor and should be referenced for complete CoFR accountability.

8.2.1 Flight Preparation Process Plans

Each organization's FPPP defines the processes and products the organization will complete for a each mission. The FPPP ensures the successful assembly, launch and completion of the flight. As applicable for each organization, the process plans shall encompass all major and critical operations, design, certification, analyses, testing, documentation, and requirements definition required for the each mission. The major processes involved are as follows:

a. Vehicle processing

b. Payload processing

c. Configuration management/requirements definition

d. Flight certification (including Launch Commit Criteria [LCC], flight rules, etc.)

e. Facility/equipment/GSE certification

f. Personnel certification

g. Special testing/analyses

h. Material review

i. Hazard analyses

j. Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL)

k. Crew training/medical certification

l. Validation that external inputs are appropriate for this specific flight

In addition, the following products and processes which organizations participate in, but are not their unique responsibilities, shall be completed in support to external organizations:

a. Develop/validate/deliver products requested by external organizations

b. Delivery of hardware or software and support data

c. Operations and Maintenance Requirements and Specifications Document (OMRSD)/LCC requirements definition

d. Configuration drawings

e. Anomaly/discrepancy resolution

f. Flight rules requirements

g. Crew procedures requirements

h. Flight design definition

i. Flight constraints definition

j. Ferry requirements

k. Time, cycle, age life, interval inspection, and maintenance requirements

l. Flight Data File (FDF) requirements

8.3 FLIGHT READINESS REVIEW PREPARATION

Each organization shall be responsible for conducting a Pre–FRR in preparation for the SSP FRR which ensures their project FPPPs are satisfied. The program/projects shall review the major processes as defined in Paragraph 8.2.1. In addition, the program/projects will address any significant issues encountered during processing and external inputs required from other organizations to ensure their compliance and completeness. After a review of these items, the program/projects will identify significant items to be reviewed by the Manager, Launch Integration for presentation at the FRR.

8.4 FLIGHT PREPARATION PROCESS EXCEPTIONS

In cases where the FPPs have not been successfully completed, CoFR exceptions will be taken. Exceptions may be originated by either the contractor or NASA and are entered on the FRR CoFR Exception Log. The resolution of each exception shall be made by the contractor and NASA organization responsible for the items to which the exception pertains. All closure rationale will be submitted to the Lead Center Director for Space Shuttle and Space Station Programs or designated representative, who will determine the acceptability of the closure rationale. The status of exceptions identified at the FRR shall be presented at the PMMT Review (reference NSTS 07700, Volume VIII, Appendix D).

The review secretariat is responsible for reporting the status of all exceptions to the Manager, Launch Integration.

8.5 RESPONSIBILITIES

a. The FRR Board, chaired by the Lead Center Director for Space Shuttle and Space Station Programs, will assess the readiness for flight. The determination of readiness for flight is the responsibility of the Lead Center Director for Space Shuttle and Space Station Programs, or designated representative. Board membership is defined in Paragraph 8.6.

b. The Manager, Launch Integration is responsible for the conduct of the FRR. Further responsibilities include the definition of the CoFR requirements and assuring their implementation by the responsible SSP organizations; the coordination of the FRR presentation material to be presented to the board; planning, coordinating and implementing the FRR agenda; and tracking, coordinating, statusing, and ensuring closeout of FRR actions items and CoFR exceptions.

c. The Manager, Launch Integration is responsible for assuring the flight readiness of the requisite flight and ground system configurations after the successful completion of the FRR.

d. The Program/Project Managers, and contractor managers, will ensure their FPPs are successfully accomplished. A formal presentation will not be required if a project has no significant changes to the baseline configuration, no issues, no constraints, no out-of-family concerns, no CoFR exceptions, no constraining IFAs from previous missions or no special topics, and submits a readiness statement stating the same. The readiness statement will be included in the FRR presentation package. Each Program Manager, Project Manager, and designated contractor managers will complete and sign the CoFR Endorsement.

e. In addition to the individual project/program responsibilities each Program/ Project Manager is responsible for reviewing the following items:

   1. The status of constraints to flight readiness

   2. Acceptability of waivers, deviations, and exceptions

   3. Acceptability of unexplained anomalies, problems, and IFAs

   4. Certification of personnel training

   5. Design requirements, analyses and/or assessments are defined in appropriate documents and released/furnished

   6. Potential safety issues and hazards

   7. Exceptions and action items from previous reviews

   8. Open work and/or actions are planned and scheduled

The following sections identify those tasks or responsibilities for which specific projects are uniquely accountable and/or responsible.

8.5.1 Space Shuttle Vehicle Engineering

8.5.1.1 Space Shuttle Vehicle Engineering Unique Responsibilities

The primary responsibilities of the SSVEO in the FPP are to: maintain insight, audit, and surveillance of the SFOC contractors activities related to the Orbiter Vehicle, flight crew equipment, and flight software; participate in out–of–family SFOC activities, provide definition and control of program requirements; manage new developments, and review hardware and software changes that affect certification. For non–transitioned hardware or software, new developments, and SFOC activities, the SSVEO will ensure that the following are satisfied:

a. Waivers, exceptions, deviations, and restricted hardware are appropriately dispositioned.

b. Orbiter and crew equipment as-built configuration satisfies the released requirements and engineering requirements.

c. Crew equipment flight hardware processing is complete.

d. Necessary safety analysis, materials tests, and certification and flight readiness requirements are completed.

e. All equipment defined in the Crew Compartment Configuration Drawing (CCCD), plus Drawing Change Notices (DCNs), the Mission Equipment Cargo Support Launch Site Installation (MECSLSI) Drawing and/or the crew equipment list, that one is responsible for, is processed for flight by approved procedures, which includes the equipment by locker and installation location.

f. All changes or deviations to critical processes in equipment preparation are reported.

g. Software Readiness Review is satisfactorily completed to ensure that the software–responsible organizations have accomplished their processes and that the mission software is ready to fly.

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8.5.2 EVA Project Office

8.5.2.1 EVA Project Unique Responsibilities

The EVA Project Office FPP includes but is not limited to the following responsibilities: direct responsibility for products not delivered by SFOC and is responsible for insight, audit, and surveillance of the SFOC contractors activities related to EVA equipment; including management of out–of–family activities, definition and control of EVA requirements, management of new developments, and review of hardware changes that affect certification:

a. All equipment changes approved by the EVA Configuration Control Board and EVA Hardware Board are incorporated.

b. All changes or deviations to critical processes in equipment preparation are reported.

c. The flight crew training and certification for performance of all scheduled, unscheduled, and contingency EVA requirements are reviewed and concurred.

d. The published procedure verification matrix for all scheduled, unscheduled, and contingency EVA scenarios are reviewed and concurred on.

e. All finalized and published EVA checklists are reviewed and concurred on.

f. All finalized and published EVA flight rules are reviewed and concurred on.

g. A realtime mission support plan is published and distributed to key personnel – scheduled EVA missions only.

h. The EVA Annex 11 (if required) is approved and published through the Integration Control Board (ICB) process.

i. All FDF–documented EVA scenarios and hardware applications are reviewed and verified to be within accepted certification limits (i.e., structural limit loads).

j. Engineering training hardware is verified for flight–like accuracy. Any known discrepancies or shortcomings are identified to MOD training personnel and the flight crew.

k. All scheduled, unscheduled, and contingency EVA scenarios and required support hardware are reviewed and certified as safe for flight.

l. The System Safety Review processes are completed according to normal procedures.

m. EVA as–built configuration satisfies the released requirements and engineering based on data provided by SFOC.

The EVA project FRR is an open forum meeting with presentations from all elements. These presentations review all items defined therein. Details of their preparation are defined in Appendix B for the EVA Project Office, and Appendix R for SFOC responsibilities.

8.5.2.2 EVA Products

EVA hardware and supporting documentation including that provided by the SFOC contractor is as follows:

a. EVA hardware

   1. EMU

   2. EMU–associated support equipment (e.g., maintenance kits)

   3. EVA tools and crew aids (including tethers, lights, Crew and Equipment Translation Aid [CETA] carts, foot restraints, etc.)

   4. Simplified Aid for EVA Rescue (SAFER)

b. EVA documentation

   1. Requirements document for the hardware.

   2. SOW and specification for hardware, as required.

   3. CoFRs for new or modified items of EVA flight hardware (generated as required)

4. FMEA
5. CIL
6. SIADs
7. PDA tests
8. SAR
9. HAR
10. OMRSD inputs, as required.

Other documentation for EVA–related items (drawings, certification documentation, stowage lists, flight rules, flight hardware processing reports, etc.) is used by the EVA Project Office but fall within the responsibility of other organizations.

8.5.3 SSME

8.5.3.1 SSME Project Unique Responsibilities

The SSME Project shall ensure the following for their as–delivered element through audit, limited surveillance, and out–of–family teaming:

a. An acceptance review or equivalent is satisfactorily completed and a DD 250 or DD 1149 executed.

b. Each departure from specifications and drawings is approved by the MRB.

c. Acceptance checkout is successfully completed in accordance with the specified requirements documents.

d. A Configuration Inspection (CI) is satisfactorily completed.

e. All unplanned/deferred work is defined in the Acceptance Data Package (ADP), is accepted for transfer to the using site, and any impacts to processing are identified.

f. Functional GFE are installed and accepted.

g. There are no open key issues affecting the as–delivered element.

h. The as–delivered element is ready for transfer to the using site.

i. SSME as–built configuration satisfies released engineering based on data provided by SFOC.

8.5.3.2 SSME Products

The components necessary to assemble a flight set of SSMEs.

8.5.4 External Tank

8.5.4.1 External Tank Project Unique Responsibilities

The ET Project shall ensure the following for their as–delivered element through audit, limited surveillance, and out–of–family teaming:

a. An acceptance review or equivalent is satisfactorily completed and a DD 250 or DD 1149 executed.

b. Each departure from specifications and drawings is approved by the MRB.

c. Acceptance checkout is successfully completed in accordance with the specified requirements documents.

d. A CI is satisfactorily completed.

e. All unplanned/deferred work is defined in the ADP, is accepted for transfer to the using site, and any impacts to processing are identified.

f. Functional GFE are installed and accepted.

g. There are no open key issues affecting the as–delivered element.

h. The as–delivered element is ready for transfer to the using site.

i. ET as–built configuration satisfies released engineering based on data provided by SFOC.

8.5.4.2 ET Products

The components necessary to assemble an ET.

8.5.5 Reusable Solid Rocket Motor

8.5.5.1 RSRM Project Unique Responsibilities

Upon delivery of the RSRM element, the RSRM Project shall ensure the following through audit, limited surveillance, and out–of–family teaming:

a. An acceptance review or equivalent is satisfactorily completed and a DD 250 or DD 1149 executed.

b. Each departure from specifications and drawings is approved by the MRB.

c. Acceptance checkout is successfully completed in accordance with the specified requirements documents.

d. A CI is satisfactorily completed.

e. All unplanned/deferred work is defined in the ADP, is accepted for transfer to the using site, and any impacts to processing are identified.

f. Functional GFE are installed and accepted.

g. There are no open key issues affecting the as–delivered element.

h. The as–delivered element is ready for transfer to the using site.

Upon completion of flight processing, the RSRM Project shall ensure the following through audit, limited surveillance, and out–of–family teaming:

a. Certified flight hardware element are delivered to Shuttle Processing at KSC.

b. Required hardware element processing specifications and requirements are delivered to Shuttle Processing at KSC.

c. All identified out–of–family events that occurred after delivery of hardware for launch processing/assembly/testing are resolved.

d. For out–of–family conditions detected during manufacturing, testing, or post–mission tear down and analysis, appropriate notification to the SSP is made, and corrective action, if any, identified.

e. RSRM as–built flight element configuration satisfies the released requirements and engineering based on data provided by SFOC.

8.5.5.2 RSRM Products

The components necessary to assemble a flight motor set.

8.5.6 Solid Rocket Booster

8.5.6.1 SRB Project Unique Responsibilities

The SRB project primary responsibilities are to maintain insight, audit and surveillance of the SFOC contractor for delivery of the SRB element and includes management of out–of–family activities, management of hardware changes and development that affect certification. These responsibilities are accomplished by ensuring the following:

a. An acceptance review or equivalent is satisfactorily completed and a DD 1149 executed.

b. Each departure from specifications and drawings is approved by the MRB.

c. Acceptance checkout is successfully completed in accordance with the specified requirements documents.

d. A CI is satisfactorily completed.

e. All unplanned/deferred work is defined in the ADP, is accepted for transfer to the using site, and any impacts to processing are identified.

f. Functional GFE are installed and accepted.

g. There are no open key issues affecting the as–delivered element.

h. The as–delivered element is ready for transfer to the using site.

i. SRB as–built configuration satisfies the released requirements and engineering based on data provided by SFOC.

8.5.6.2 SRB Products

The following products are produced by the SRB project:

a. Flight readiness statement for the SRB project.

8.5.7 Mission Operations Directorate (MOD)

8.5.7.1 MOD Unique Responsibilities

The JSC MOD is responsible for and shall ensure the following:

a. **Flight Rules** – The STS operational flight rules and flight–specific annexes are defined, reviewed, approved, and released for flight.

b. **Flight Data File** – The government accountable FDF is generated and controlled as specified in the Crew Procedures Management Plan and is certified as ready for flight.

c. **Team Certification** – The NASA Mission Control Center (MCC) flight control team members are certified for flight and the integrated NASA/contractor MCC flight control and support teams involved in direct mission execution are flight ready.

d. **Facility Readiness** – All MOD facilities required for direct flight support as well as the network facilities are tested, verified, and certified.

e. **Flight Planning and Reconfiguration Products** – Program requirements for flight planning and mission reconfiguration products were delivered to the SFOC contractor for standard process execution.

f. **Launch Commit Criteria Minimum Equipment List (MEL)/Mandatory Instrumentation List (MIL)** – The LCC MEL and MILs are verified as complete and accurate.

g. **Contractor Process Insight** – Process insight of contractor accountable flight preparation processes has detected no problems that impact flight readiness.

8.5.7.2 MOD Products

The following is a list of products developed by the JSC MOD during the FPP.

a. NSTS 12820, Space Shuttle Operational Flight Rules, All Flights, Volumes I and II

b. NSTS 18308, Space Shuttle Operational Flight Rules, Annex

c. Validated government accountable FDF

d. Certified government accountable Flight Control Team (FCT)

e. Approved LCC Change Notice (LCN) for Appendix H of NSTS 16007, Shuttle Launch Commit Criteria and Background Document

f. Approved LCN for Appendix I of NSTS 16007

8.5.8 Shuttle Processing

8.5.8.1 Shuttle Processing Unique Responsibilities

The Shuttle Processing FPP includes, but is not limited to, the following responsibilities:

a. GSE and facilities hardware and software are certified/validated, and are ready to support launch.

b. Flight, GSE, and facilities hardware/software configuration requirements levied on Shuttle Processing are performed, or planned to be performed, per approved TOPs.

c. Flight, GSE, and facilities test requirements levied on Shuttle Processing are performed, or are planned to be performed, per approved TOPs.

d. LCC defined for this mission are implemented.

e. All significant differences from previous flights are reviewed, and where required, are incorporated in applicable documents.

f. The landing sites are properly configured and landing site personnel are ready to be deployed.

Shuttle Processing will ensure the following logistics responsibilities:

a. All intermediate/depot level maintenance items are repaired/modified/replaced in accordance with requirements.

b. All logistics operations support requirements are compiled to in accordance with procedures.

c. All material management requirements are compiled to in accordance with procedures.

d. The availability of launch critical spares are determined by a spares reservation policy.

e. The Ferry Flight Readiness Report for ferry kit hardware is provided to the Ferry Flight Manager.

8.5.8.2 Shuttle Processing Products

The following is a list of primary products produced by SFOC and verified by NASA through audit, surveillance and insight, required by the SSP to support the Shuttle Processing FPP:

a. Flight–ready integrated Space Shuttle Vehicle

    1. Operations and Maintenance Plan (OMP)

    2. Ground Launch Sequencer (GLS) Description Document (DD)

b. Certified and validated KSC ground facilities, systems, and equipment

c. Certified and validated KSC ground applications software

d. Trained and certified NASA and SFOC launch, landing and recovery team personnel

8.5.9 (Deleted)

8.5.10 ISS/Payloads Processing

8.5.10.1 ISS/Payloads Processing Unique Responsibilities

ISS/Payloads Processing shall ensure the following requirements are met:

a. All payload installations and interface verifications are successfully completed in accordance with the payload installation and checkout requirements.

b. All certification/verifications requirements for payload processing, as defined for this mission, are satisfied.

c. All payload TOPs issued for launch, landing, and contingency activities are approved and released. All remaining work is defined on an approved schedule.

d. Payload–unique LCC defined for this mission are implemented.

e. KSC payload–unique GSE, facilities, hardware, and software are validated and ready to support launch.

f. Payload–unique landing site GSE, hardware, and software are properly configured. Payload personnel are ready to be deployed.

ISS/Payloads Processing will ensure the following logistics responsibilities:

a. All intermediate/depot level maintenance items are repaired/modified/replaced in accordance with requirements.

b. All logistics operations support requirements are compiled with in accordance with procedures.

c. All material management requirements are compiled with in accordance with procedures.

d. The availability of launch critical spares are determined by a spares reservation policy.

8.5.10.2 ISS/Payloads Processing Products

a. The following is a list of products developed by ISS/Payloads Processing to support the Space Shuttle Mission

   1. Flight–ready integrated payload flight hardware

   2. Launch Site Support Plan (LSSP)

   3. Operations and Maintenance Requirements and Specifications (OMRS) Requirements Allocation Matrix (RAM) (payload files only)

   4. Processing plans and schedules

   5. Technical Operating Procedures (TOPs)

   6. Problem Reporting and Corrective Action (PRACA) closure reports

   7. Payload hazard reports

8. Payload Ground Operations Aerospace Language (GOAL) Programs
9. As–Built Configuration List (ABCL)
10. Training reports

8.5.11 Flight Crew Operations

8.5.11.1 Flight Crew Operations Unique Responsibilities

Flight Crew Operations shall ensure the following:

a. Space Shuttle crews are adequately trained to execute the mission.

b. Space Shuttle crews are medically qualified to execute the mission.

c. Mission operations support personnel, to include Capsule Communicators (CAPCOMs) and Astronaut Support Persons (ASPs), are certified to support the mission.

d. L&L support aircraft are properly maintained and in service.

e. Aircraft required for spaceflight readiness training are properly maintained and in service.

f. Pilots, flight engineers, and maintenance personnel are current and certified.

g. Flight crew operations considerations are represented in the process of mission development and execution.

8.5.11.2 Flight Crew Operations Products

Flight Crew Operations provides the following products:

a. Flight crews trained and medically qualified to execute the mission.

b. Flight operations personnel trained and certified to support the mission.

c. Aircraft necessary to support L&L operations.

d. Aircraft required for spaceflight readiness training.

e. Flight crews participation in the successful resolution of preflight issues resulting from mission planning or anomalies from previous missions.

8.5.12 Space Shuttle KSC Integration

8.5.12.1 Space Shuttle KSC Integration Unique Responsibilities

The Space Shuttle KSC Integration shall ensure the following:

a. Requirements are approved in related integrated vehicle configuration drawings.

b. LCC requirements identified are defined and approved.

c. Requirements identified are approved (excluding File II, Volumes 2, 4, and 6, File III [except Volume 41], File VII, File VIII, and File IX, Volume 2 [except Appendix B]) and incorporated in OMRS.

d. All LCC deviations are evaluated, properly dispositioned and approved for launch countdown.

e. Out–of–family issues identified by the contractor have been evaluated and properly dispositioned for flight.

8.5.12.2 Space Shuttle KSC Integration Products

a. The following is a list of the products provided by KSC Integration in support of the Space Shuttle Mission:

1.	V072–000001	Space Shuttle System Drawings
2.	V072–300055	Ferry Configuration Drawings
3.	NSTS 16007	Shuttle Launch Commit Criteria and Background Document
4.	Integrated OMRS (File II, Volume I)	
5.	NSTS 08171	OMRSD

8.5.13 Space Shuttle Systems Integration

8.5.13.1 Space Shuttle Systems Integration Unique Responsibilities

The primary activities of the Space Shuttle Systems Integration Office in the FPP is to: maintain insight, audit, and surveillance of the SFOC contractor’s FPP; manage out–of–family activities; provide definition and control of program requirements; manage new developments that affect math models, data bases and environments; review hardware and software changes that affect certification.

The following defines responsibilities of the Space Shuttle Systems Integration Office for the FPP:

a. Periodic audit of the SFOC contractor’s FPP.

b. Review and approval of any process changes proposed by the SFOC contractor.

c. Management/approval of out–of–family activities including: hardware issues that are first time occurrences, limit life or restrict re–use, change weight, and/or affect performance/reliability/safety; items that affect government controlled flight or ground operation procedures; changes to systems requirements and critical math models or data bases; changes/updates to induced environments; software or hardware configuration changes; items that require waivers or exceptions for hardware that does not meet performance/certification/life cycle requirements; resolution of unexplained anomalies; items that require special government analysis/design assistance; and, items that affect critical hardware manufacture or repair and Acute Launch Emergency Reliability Tips (ALERTs) that require systems integration evaluation.

d. Approve changes to NSTS 08329, Volume VIII, DOLILU II Definition and Requirements Document, DOLILU Operations Support Plan related products and data bases.

e. Verify that International Space Station (ISS) assembly flights and Mir flights cargo integration analysis of the on–orbit stability/control, structural, passive and active thermal control analyses are completed and documented for the mission phase in which the Orbiter is within 1,000 feet of the ISS or Mir structure.

f. Review/approve Orbiter mid–deck acoustic loads.

g. Close or evaluate all cargo GFE CARs as no constraint to flight.

h. Review and approve Interface Revision Notices (IRNs) to system level ICDs and mission noncompliances in ICD–2–19001, Shuttle Orbiter/Cargo Standard Interface Control Document, Attachment 1.

i. Review and approve deviations, and exceedances applicable to payload unique ICDs and obtain Program Requirements Control Board (PRCB) approval of waivers to ICDs.

j. Certify all cargo integration GFE for flight.

k. Review the integrated avionics hardware interfaces for Mir and ISS assembly flights as acceptable for flight.

l. Evaluate electromagnetic effects for radiated and conducted emissions to determine readiness for Mir and ISS assembly flights.

8.5.13.2 Space Shuttle Systems Integration Products

The following products are provided by the Space Shuttle Systems Integration Office for the FPP:

a. Mir and ISS on–orbit assembly loads, flight control, and active and passive thermal analyses results/Verification Analysis Reports documents and presentations.

b. Orbiter mid–deck acoustic environments report.

c. Mir and ISS on–orbit plume impingement loads/models.

d. Letter to the Flight Director documenting that all Electromagnetic Compatibility (EMC) and Electromagnetic Interference (EMI) analysis results are complete for the Orbiter/ISS assembly and Mir flights.

e. Mir and ISS assembly flights Radio Frequency (RF) constraints in the NSTS 17462–(mission number), Flight Requirements Document (FRD), Section 4.2, are met.

f. Environmental compatibility assessment for Mir and ISS assembly flights.

g. Preflight Readiness Review presentations, readiness statements

8.5.14 Space Shuttle Customer and Flight Integration

8.5.14.1 Space Shuttle Customer and Flight Integration Unique Responsibilities

The Space Shuttle Customer and Flight Integration shall ensure the following:

a. Program approved mission–specific characteristics and hardware element assignments are reflected in the Flight Definition and Requirements Directive (FDRD).

b. All payload integration and operational requirements, characteristics data, analyses, and assessments are defined in respective integration plans and their associated annexes and are released in support of mission planning and preparation activities.

c. All payloads manifested are consistent with agency priorities, hardware availability, and have operational requirements that are compatible with mission capability.

d. All mission requirements, characteristics data, analyses and assessments are defined in flight requirements documentation and are released in support of mission planning and preparation activities.

e. All Detailed Test Objectives (DTOs), Detailed Supplementary Objectives (DSOs), and RMEs assigned to the mission have requirements, characteristics data, analyses, and assessments defined in flight test and supplementary objectives documentation and are released in support of mission planning and preparation activities.

8.5.14.2 Space Shuttle Customer and Flight Integration Products

Space Shuttle Customer and Flight Integration is responsible for the following products:

a. Integration plans

b. Safety noncompliance reports development

c. NSTS 07700, Volume III, Flight Definition and Requirements Directive, Table 4.1

d. Flight Requirements Documents (FRDs)

e. Plug–in Plans

f. NSTS 08171, OMRSD, File II, Volumes 2, 4, and 6

g. NSTS 16725, Flight Tests and Supplementary Objectives Document (FTSOD)

8.5.14.3 Payload Safety Review Panel Unique Responsibilities

The Payload Safety Review Panel (PSRP) shall ensure that the payloads are reviewed for adequate safety implementation.

8.5.14.4 Payload Safety Review Panel Products

The PSRP is responsible for the following product: Hazard reports

8.5.15 Space and Life Sciences

8.5.15.1 Space and Life Sciences Unique Responsibilities

The Space and Life Sciences Directorate will ensure that the following requirements are met:

a. Flight crew health certification is complete/on schedule.

b. Toxicological assessments are complete.

c. Potable water quality assessments are complete.

d. Microbiological assessments are complete.

e. All radiation assessments are complete.

f. Earth observation flight crew training is complete and products provided.

g. Meteor/orbital debris assessments are complete.

8.5.15.2 Space and Life Sciences Products

The following is a list of products provisioned by the Space and Life Sciences.

a. Flight crew health certification

b. Shuttle Orbiter Medical System (SOMS) kit/eye wear

c. Flight rules/medical checklist updates to FDF

d. Toxicological assessment

e. Potable water quality assessment

f. Microbiological assessments

g. Crew radiation exposure assessment

h. EVA crew radiation exposure assessment

i. Onboard radioactivity assessment

j. Earth observation maps, Atlas, and Mission Elapsed Time (MET) list for FDF

k. Meteor/orbital debris assessments

l. Flight crew/operations personnel training

8.5.16 Ferry Operations

8.5.16.1 Ferry Operations Unique Responsibilities

The assigned Ferry Manager shall ensure the following:

a. Ferry requirements are ready to support ferry operations.

b. All enroute support facilities are ready.

c. Aircraft and equipment are ready to support Orbiter ferry operations.

d. The Ferry Flight Milestone Review is successfully completed prior to Orbiter ferry.

8.5.17 Space Shuttle SR&QA

8.5.17.1 Space Shuttle SR&QA Unique Responsibilities

The Space Shuttle SR&QA Office is accountable for:

a. NASA Safety Reporting System

b. Surveillance and audits

8.5.17.2 Space Shuttle SR&QA Products

Space Shuttle SR&QA is responsible for the following products:

a. Hardware acceptance (DD 250 Signature)

b. In–line SR&QA support to the projects/elements

c. System Safety Review Panel assessment

d. Ground Safety Review Panel assessment

e. NASA Safety Reporting System assessment

f. Prelaunch Assessment Review assessment

g. GICHA control verification

8.5.18 Space Flight Operations Contractor (SFOC)

8.5.18.1 SFOC Unique Responsibilities

The SFOC shall ensure that the following within their current scope of work is completed for the FPP.

a. All flight and ground element processing activities have been performed in accordance with approved engineering and work authorization documents.

b. Flight software has been developed per released requirements, verified, and implemented to support the mission.

c. All necessary hardware has been certified and delivered to support the mission and is within the age, life, and time cycle requirements.

d. All CARs and ALERTs applicable to cargo integration hardware have been reviewed and are acceptable for flight.

e. All ground operations personnel actively participating are trained and/or certified, as required.

f. All launch preparation tasks are completed in support of launch.

g. Mission design requirements are identified, products generated and delivered based on the requirements for flight/mission execution.

h. The systems level drawings, cargo engineering drawings, and CCCD have been generated and distributed according to NASA baseline requirements.

i. Electromagnetic effects evaluations for radiated and conducted emissions for payloads flight readiness are completed.

j. Requirements are defined and included in released payload ICDs, IRDs, PIP Annex 1, and the payload OMRSD.

k. All changes to program requirements (e.g., ICDs, OMRS, LCC, flight rules, crew procedures, critical processes, materials and processes, and Launch Processing System [LPS] software) including waivers, deviations, and exceptions have been reviewed, concurred on, and implemented to support the launch.

l. Orbiter design changes are identified, reviewed, approved, certified, and implemented to support Orbiter processing.

m. All ascent flight design requirements have been defined.

n. The TDDP has been published using approved baseline documentation.

o. Required analyses have been performed to update and maintain the DOLILU Operations Support System (DOSS).

p. Verify that compatibility analysis of the mission phases in which the Orbiter is outside of 1,000 feet of the ISS or Mir structure for loads, thermal, and on–orbit stability and control analyses of the integrated Shuttle/cargo systems have been completed.

q. All training of flight operations personnel, including flight–specific crew training, integrated training/simulations, facility operations personnel/instructors has been completed and certified, as required.

r. All SFOC accountable facilities including Mission Control Center (MCC), Integrated Planning System (IPS), Integrated Test Facility (ITF), Software Production Facility (SPF), and Shuttle Avionics Integration Laboratory (SAIL) are ready for mission support.

s. All Flight Data Files (FDF) have been prepared and delivered as required.

t. The as–built configuration has been verified to be in accordance with the approved engineering and program directives.

u. Facility, communications, and telemetry requirements for flight operations support activities have been coordinated with NASA and implemented in ground facilities.

v. Landing Operations have been assessed, readiness reviews conducted, and all issues resolved.

w. SRB recovery and disassembly operations have been assessed, readiness reviews conducted, and all issues resolved.

x. All requirements required to process the Orbiter for ferry flight have been reviewed and implemented in order to support the ferry readiness.

y. Integrated vehicle contingency operations have been identified and contingency planning has been incorporated.

z. A review of potential safety issues and hazards has been conducted and all identified issues have been resolved.

aa. All anomalies that potentially impact processing, launch, mission success, or landing have been reported and successfully resolved with NASA.

bb. A post–flight assessment of the actual SSV flight systems performance has been conducted and all discrepancies have been resolved.

cc. Approval has been obtained from NASA for all out–of–family dispositions.

dd. Element subcontractors have technically concurred with the processing and the hardware requirements and have certified that the individual elements are safe to fly.

ee. A project level Pre–FRR has been conducted.

ff. All FCE/EVA equipment changes are approved by the appropriate CCB.

8.5.18.2 SFOC Unique Products

The following products are produced by SFOC and/or its contractor for the FPP:

a. Validated Contractor Accountable Function (CAF) Flight Data File (FDF).

b. Trained flight crew and Flight Control Team (FCT).

c. Flight–ready Mission Control Center (MCC) and Network interface.

d. Trained and certified CAF FCT members and MCC support team.

e. Shuttle Mission Simulator (SMS) configured per mission–specific training requirements.

f. Flight–ready Software Production Facility (SPF) and mission support plan.

g. Flight–ready Integrated Planning System (IPS) and Network interface.

h. Mission–specific reconfiguration products including, Shuttle Data Tape (SDT) and MCC, SMS and SPF reconfiguration products.

i. Certified Orbiter vehicle.

j. Certified Orbiter mission kits.

k. Certified Orbiter modification kits.

l. Data as defined in Orbiter related Information Requirements Documents (IRDs).

m. PASS and BFS software and products as per the Class 1 Integration Plan, the MMU Integration Plan, and the Reconfiguration Performance Test Plan.

n. PASS and BFS Requirements Documents and ICDs.

o. Integrated Avionics Verification Test Requirements Document and Integrated Avionics Verification Test and Analysis Report.

p. Flight–ready integrated Space Shuttle Vehicle, Operations and Maintenance Plan (OMP) and Ground Launch Sequencer (GLS) Description Document (DD).

q. Certified and validated KSC ground facilities, systems, and equipment.

r. Certified and validated KSC ground applications software.

s. Trained launch team personnel.

t. Completed integrated mission–specific ascent design and Flight Readiness Verification (FRV).

u. Trajectory Design Data Packages (TDDP).

v. Trajectory design freeze point CR.

w. DOSS flight–specific data.

x. Payload and systems ICDs and IRDs are developed and released.

y. Cargo thermal and loads data reports.

z. Cargo engineering drawings/schematics/technical orders.

aa. Certified cargo integration hardware.

bb. Cargo integration hardware certification.

cc. Payload environmental impact statement.

dd. Cargo compatibility assessments including payloads EMI and EMC evaluation report.

ee. Payload Integration Plan (PIP) Annex 1.

ff. Payload Operations and Maintenance Requirements and Specifications (OMRSD) Requirements Change Notices (RCN).

gg. In–Fight Anomaly (IFA) evaluation reports.

hh. Mission–specific environments (as required).

ii. Mission non–compliance to ICD–2–19001.

jj. Safety evaluations and hazards summary reports.

kk. Cargo mid–deck locker weight and center–of–gravity report.

ll. Crew compartment equipment: photographic, optical, lighting, electronic still camera, educational.

mm. Crew use items: food/galley/food warmer, clothing/soft goods/linens, hygiene, personal/off–duty, housekeeping, eye wear, tools, restraints, sleep provisions, trash management.

nn. Crew contingency use items: hoses/adapters, ground emergency egress equipment, launch escape suit, Spacelab emergency breathing system.

oo. Crew compartment stowage, including decals/placards.

pp. Electrical measurement/distribution provisions.

qq. Thermoelectric Liquid Cooling System (TELCS).

rr. Biomedical Instrumentation Plug (BIP).

ss. Hardware: requirements document, Statement of Work (SOW)/specifications, drawings, CoFRs for new FCE/EVA hardware.

tt. Hardware certification including, documentation, certification test plans/procedures/reports, safety compliance and reliability certification data package.

uu. Mission–specific drawings/documentation: EE2–91–011/XX, Camcorder System Assembly Kit Stowage Document, food drawing, stowed clothing drawing.

vv. Data/Documents: flight photo equipment list, functional end item data packages, JSC Form 1027, Bench Review Report, 911 tags.

ww. Hardware Assembly Test: Specification and Assembly Drawings (SIADs), Pre–delivery Acceptance (PDA) tests, Pre–installation Acceptance (PIA) tests, Test Preparation Sheet.

xx. Safety/Quality Assurance: Safety Analysis Report (SAR), Hazard Analysis Report (HAR), Failure Investigation Analysis Reports (FIARs), FMEA, CIL.

yy. Operations and Maintenance Requirements Document (OMRSD) inputs.

zz. EMU/associated support equipment, maintenance kits.

aaa. EVA tools and crew aids (including tethers, lights, CETA, carts, foot restraints.

bbb. SAFER.

ccc. Certified SRB forward and aft assemblies (left hand and right hand) including integrated kit.

ddd. Certified SRB left hand and right hand aft booster kit.

eee. Certified SRB to MLP kit.

fff. SRB DD 1149 form.

ggg. Flight readiness statement (all SFOC elements).

8.5.18.3

The following signatures will be obtained by the Internal SFOC CoFR Process to certify flight readiness:

a. President and CEO, SFOC

b. Vice President, SQ&MA, SFOC

c. Chief Engineer, SFOC

d. SSP, Program Manager, SFOC

e. APM, Program Integration, SFOC

f. APM, Integrated Logistics, SFOC

g. APM, Ground Operations, SFOC

h. APM, Flight Operations, SFOC

i. APM, Flight Software, SFOC

j. APM, FCE/EVA, SFOC

k. APM, SRB Element, SFOC

l. APM, Orbiter Element, SFOC

m. Program Director, Orbiter Program, Boeing–RSS

n. Program Director, Shuttle and Space Station Integration, Boeing–RSS

o. Program Director, Space Shuttle, Boeing–RSS

p. Program Manager, SRB Project, USBI

8.5.19 SSP Safety and Mission Assurance

8.5.19.1 The SSP S&MA Office is accountable for:

a. Surveillance of contractor reliability and maintainability policies.

b. Surveillance contractor products, processes and services to ensure compliance with program requirements and specifications.

c. Surveillance to ensure safety, reliability, maintainability and quality issues are correlated with mission success probabilities.

8.6 ORGANIZATION

The FRR Board is responsible for evaluating and advising the Chair on the flight readiness of the entire SSV based on their day-to-day interaction, familiarity with program status, understanding of flight hardware processing, and review of the FRR presentations.

a. FRR Board - The FRR Board will be chaired by the Lead Center Director for Space Shuttle and Space Station Programs and will include as members:

1. Manager, Space Shuttle Program
2. Manager, Launch Integration
3. AA for Safety and Mission Assurance
4. KSC, MSFC, and SSC Directors
5. AA prime mission (for non–ISS missions)
6. Program Manager, SFOC
7. Deputy AA for Space Operations
8. Deputy AA for Space Station (for ISS missions)
9. NASA Program Manager, ISS Program (for ISS missions)
10. Boeing Program Manager, ISS Program (for ISS missions)

b. FRR Meeting Attendance – Attendance at the FRR will be limited to personnel who are principals in providing and evaluating the data necessary to assess the readiness of the SSV System for flight. In addition to those on the board who assist in the assessment, and those making presentations or providing data for assessment, attendance at the FRR shall include:

1. Directors of involved programmatic and institutional organizations
2. Key contractor corporate managers
3. NASA and contractor technical representatives as required in support of the agenda
4. Payload representatives

8.7 REVIEW REQUIREMENTS

a. Presentation Emphasis – The presentation will be focused on proving readiness for flight. Agenda items will include a status summary with appropriate supporting detail on significant items as detailed below and conclude with a readiness assessment. The presentation topics and scope shall be developed from the organizational Pre–FRRs and will:

1. Provide the Director, Space Shuttle Program Lead Center with the information needed to make a decision as to flight readiness.
2. Review significant problem status. Includes all Criticality 1, 1R, 1S, and 2 items and test anomalies since previous FRR and prior flight anomalies.

3. Cover all problems, open items, constraints remaining to be resolved before the mission, deferred engineering/work and CoFR exceptions.

4. Establish the mission baseline configuration in terms of all significant changes since the last Space Shuttle mission (changes to be considered include hardware, software, SSV servicing/checkout, LCC, flight plans, flight rules, crew procedures, and hardware manufacturing critical processes).

5. Verify that all required contingency plans and procedures are current and that personnel and resources are prepared to respond to Space Shuttle contingencies.

6. Verify readiness of the Eastern Range to support the launch.

7. Provide closure status of all actions assigned at previous reviews.

8. Provide resolution of all constraints to launch identified at previous reviews.

9. Identify the disposition of all anomalies including those identified as unresolved at the organizational Pre-FRRs and any encountered since the previous review.

10. Identify resolution of all open items/open work identified at the previous reviews.

11. Assure the SCA and the Orbiter are properly configured and checked out to support the ferry flight of the Orbiter.

b. Agenda – The major agenda items and responsibilities are listed below. When major customer is ISS, each appropriate agenda item will discuss both Space Shuttle and ISS content.

1.	Introduction	Manager, Launch Integration
2.	Mission Summary	Flight Director, Mission Operations
3.	Program Integration	Flight Manager Manager, Space Shuttle KSC Integration Manager, Space Shuttle Systems Integration Manager, Space Shuttle Customer and Flight Integration APM, Program Integration, SFOC
4.	ISS Program	Manager, ISS Program (as required)

5. Payload Processing	Director of ISS/Payloads Processing, KSC
6. External Tank	Manager, External Tank Project
7. RSRM	Manager, Reusable Solid Rocket Motor Project
8. SRB	Manager, Solid Rocket Booster Project APM, SRB Element, SFOC
9. SSME	Manager, Space Shuttle Main Engine Project
10. Vehicle Engineering	Manager, Space Shuttle Vehicle Engineering APM, Orbiter Element, SFOC APM, Flight Software, SFOC APM, FCE/EVA, SFOC
11. EVA	Manager, EVA Project Program Manager, HSSSI
12. Shuttle Processing	Director of Shuttle Processing, KSC APM, Ground Operations, SFOC APM, Integrated Logistics, SFOC
13. Mission Operations	Director, Mission Operations APM, Flight Operations, SFOC
14. Flight Crew	Director, Flight Crew Operations
15. Space and Life Sciences	Director, Space and Life Sciences
16. Ferry Readiness	Ferry Operations Manager
17. Range	United States Air Force
18. DDMS	Director, DDMS
19. Space Shuttle SR&QA	Manager, Space Shuttle Safety, Reliability, and Quality Assurance
20. Exception/Action Summaries	Manager, Launch Integration
21. Readiness Poll	Lead Center Director for Space Shuttle and Space Station Programs

c. Project/Exception/Action Item Summaries - A Project Summary will be conducted prior to the Exception/Action Item Summaries for projects to answer the realtime questions. This session is not intended for viewgraph presentations or detailed technical discussions. All questions requiring additional technical information may be reported on subsequent to the FRR.

d. Readiness Poll - A readiness poll will be conducted at the conclusion of the FRR. Responses to the poll will be clear, concise, unambiguous responses concerning readiness for flight. Readiness poll responses will be required of key contractor corporate managers and the FRR board members. The readiness poll will become a part of the formal record of FRR.

e. FRR Certification - The contractor and NASA certifications are limited to contractual/organizational obligations. The program/projects are responsible for requirements definition and issue/constraint resolution, Shuttle Processing and ISS/Payloads Processing are responsible for implementation of the defined requirements. The endorsement document (reference Figure 3) is signed by the prime contractor and the NASA managers or their designated representatives. If a contractor or NASA manager delegates their attendance and endorsement signature authority for a review, a letter of delegation must be sent to the Manager, Launch Integration prior to the FRR. The letter of delegation must be signed by the contractor or NASA Program or Project Managers. Delegation to a deputy does not require a letter of authorization.

   CoFR endorsements, including a complete listing of exceptions, will be executed and submitted at the conclusion of the review.

f. FRR Assessment Letter - Following the FRR, an assessment letter will be issued by the Lead Center Director for Space Shuttle and Space Station Programs to the NASA Administrator to formally document final determination of readiness for flight.

At the conclusion of the FRR, a launch date will be set. The MMT will be activated at the PMMT Review. Any exceptions or actions remaining open at this time will be reviewed by the MMT at the PMMT Review (reference NSTS 07700 Volume VIII, Appendix D).

FIGURE 3
CoFR ENDORSEMENT

STS– ____ CoFR ENDORSEMENT

ELEMENT	SERIAL NUMBER	PAYLOAD
ORBITER		
ET		
RSRM		
SSME		
SRB		

Projects having exceptions to this CoFR document are as follows (see Exception Log for details):

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FIGURE 3
CoFR ENDORSEMENT – Continued

STS– _____ CoFR ENDORSEMENT

The Flight Preparation Process Plans documented in NSTS 08117, Requirements and Procedures for Certification of Flight Readiness, have been satisfied. Required products and other responsibilities for each project (NSTS 08117, Section 8) have been or will be produced or completed.

a. Certified flight hardware elements have been delivered to the SFOC at the Kennedy Space Center.

b. Required hardware element processing specifications and requirements have been delivered to the SFOC.

c. All identified "out-of-family" events that occurred after delivery of hardware for launch processing/ assembly/testing have been resolved.

d. For "out-of-family" conditions detected during manufacturing, testing, or post-mission tear down and analysis, notification to the Space Shuttle Program has been made, and corrective action, if any, identified.

e. The as-built flight element configuration satisfies the released requirements and engineering, based on data compiled and reviewed by SFOC.

f. For the Space Shuttle Main Engine Project: Certified main engine controller software has been delivered for this mission.

	CONTRACTOR		NASA	
SSME (8.5.3.1, 8.5.3.2, Apx. C)	PROGRAM MANAGER, ROCKETDYNE	DATE	MANAGER, SSME PROJECT, MSFC	DATE
ET (8.5.4.1, 8.5.4.2, Apx. D)	PROGRAM MANAGER, LMMSS	DATE	MANAGER, ET PROJECT, MSFC	DATE
RSRM (8.5.5.1, 8.5.5.2, Apx. E)	PROGRAM MANAGER, THIOKOL	DATE	MANAGER, RSRM PROJECT, MSFC	DATE
	CONCURRENCE			
MSFC SHUTTLE PROJECTS	N/A		MANAGER, MSFC SHUTTLE PROJECTS	DATE

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FIGURE 3
CoFR ENDORSEMENT – Continued

STS– _____ CoFR ENDORSEMENT

The Flight Preparation Process Plans documented in NSTS 08117, Requirements and Procedures for Certification of Flight Readiness, have been satisfied. Required products and other responsibilities for each organization (NSTS 08117, Section 8) have been or will be produced or completed.

a. For Payload Processing: Flight and ground requirements, payload logistics, and configuration requirements provided by the flight projects, have been maintained, performed, or are planned to be performed per approved TOPs.

b. For EVA project: Audit, insight, and surveillance of SFOC activities have been completed or are planned for completion, and all discrepancies have been resolved. Oversight functions have been conducted in conjunction with Hamilton Sundstrand.

	NASA	
FLIGHT CREW OPERATIONS (8.5.11.1, 8.5.11.2, Apx. K)	DIRECTOR, FLIGHT CREW OPERATIONS	DATE
FERRY OPERATIONS (8.5.16.1, 8.5.16.2, Apx. P)	FERRY OPERATIONS MANAGER	DATE
SPACE AND LIFE SCIENCES (8.5.15.1, 8.5.15.2, Apx. O)	DIRECTOR, SPACE AND LIFE SCIENCES	DATE
SPACE SHUTTLE SR&QA (8.5.17.1, 8.5.17.2, Apx. Q)	MANAGER, SPACE SHUTTLE SR&QA	DATE

	CONTRACTOR		NASA	
PAYLOAD PROCESSING (8.5.10.1, 8.5.10.2, Apx. J)	PROGRAM MANAGER, PGOC BOEING, KSC	DATE	DIRECTOR OF ISS/PAYLOADS PROCESSING	DATE
EVA (8.5.2.1, 8.5.2.2, Apx. B)	PROGRAM MANAGER, HAMILTON SUNDSTRAND	DATE	MANAGER, EVA PROJECT OFFICE	DATE

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FIGURE 3
CoFR ENDORSEMENT – Continued

STS– ____ CoFR ENDORSEMENT

The Flight Preparation Process Plans documented in NSTS 08117, Requirements and Procedures for Certification of Flight Readiness, have been satisfied. Required products and other responsibilities (shared or independent) for each organization (NSTS 08117, Section 8) have been or will be produced or completed.

a. The following NASA organizations have completed or plan to complete audit, insight, and surveillance of contractor activities, and have resolved all discrepancies.

NASA		
CUSTOMER AND FLIGHT INTEGRATION (8.5.14.1, 8.5.14.2, Apx. N)	MANAGER, SPACE SHUTTLE CUSTOMER AND FLIGHT INTEGRATION	DATE
KSC INTEGRATION (8.5.12.1, 8.5.12.2, Apx. L)	MANAGER, SPACE SHUTTLE KSC INTEGRATION	DATE
SHUTTLE PROCESSING (8.5.8.1, 8.5.8.2, Apx. H)	DIRECTOR OF SHUTTLE PROCESSING, KSC	DATE
MISSION OPERATIONS (8.5.7.1, 8.5.7.2, Apx. G)	DIRECTOR, MISSION OPERATIONS	DATE
SRB (8.5.6.1, 8.5.6.2, Apx. F)	MANAGER, SRB PROJECT, MSFC	DATE
SSP S&MA	MANAGER, SSP S&MA	DATE
SYSTEMS INTEGRATION (8.5.13.1, 8.5.13.2, Apx. M)	MANAGER, SPACE SHUTTLE SYSTEMS INTEGRATION	DATE
VEHICLE ENGINEERING (8.5.1.1, 8.5.1.2, Apx. A)	MANAGER, SPACE SHUTTLE VEHICLE ENGINEERING	DATE

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FIGURE 3
CoFR ENDORSEMENT – Continued

STS– _____ CoFR ENDORSEMENT

The Flight Preparation Process Plans (shared or independent) documented in NSTS 08117, Requirements and Procedures for Certification of Flight Readiness, have been satisfied. Required products and other responsibilities (shared or independent) for the SFOC (NSTS 08117, Section 8) have been or will be produced or completed.

a. All out of family conditions have been identified and resolved with the NASA.

b. The SSV has been processed in accordance with requirements and policies baselined by the SSP.

UNITED SPACE ALLIANCE

SFOC SQ&MA CONCURRENCE	VICE PRESIDENT, SAFETY, QUALITY AND MISSION ASSURANCE, UNITED SPACE ALLIANCE	DATE
SFOC (8.5.18.1, 8.5.18.2, Apx. R)	SSP, PROGRAM MANAGER, SFOC	DATE

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FIGURE 3
CoFR ENDORSEMENT – Concluded

STS– _____ CoFR ENDORSEMENT

READINESS

The preparation of all Space Shuttle Program and Project organizations for this mission has been reviewed. All required processes, products, and responsibilities are complete or will be completed prior to launch. Deviations, exceptions or waivers have been reviewed and will be dispositioned by the MMT L-2 Day Review for this mission. The Space Shuttle Program is ready to proceed with conduct of this mission.

MANAGER, SPACE SHUTTLE PROGRAM INTEGRATION	DATE
MANAGER, LAUNCH INTEGRATION	DATE
MANAGER, SPACE SHUTTLE PROGRAM	DATE

CONCURRENCE

NASA S&MA has reviewed the status of preparations for this mission and has performed an independent assessment of the readiness of the Space Shuttle Program for the conduct of this mission. We are in concurrence with proceeding with this mission.

ASSOCIATE ADMINISTRATOR, SAFETY AND MISSION ASSURANCE	DATE

APPROVAL

The FRR Board has conducted a comprehensive assessment of the readiness of all flight and ground systems and supporting personnel. The Certificate of Flight Readiness has been endorsed by each program element. I have concluded, with the concurrence of the FRR Board, that pending completion of planned work, the Space Shuttle Program is ready to execute this mission.

DIRECTOR, SPACE SHUTTLE PROGRAM LEAD CENTER (CHAIR, FRR BOARD)	DATE

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FIGURE 4

CoFR EXCEPTION FORM

CoFR EXCEPTION FORM			
EXCEPTION NUMBER:	ELEMENT: SERIAL NUMBER:	STS FLT NUMBER:	
REQUIREMENT/DESCRIPTION OF EXCEPTION:			
INITIATOR/TITLE:		DATE:	
CONCURRENCE/TITLE:		DATE:	
ACTION/ACTIONEE:		DUE DATE:	
REVIEW BOARD CHAIR:		DATE:	

RESOLUTION OF EXCEPTION:			DATE RESOLVED:
CONTRACTOR MANAGER:	DATE:	NASA PROJECT MANAGER:	DATE:
SPACE SHUTTLE PROGRAM			DATE:

SSP Form 4043 (Rev Jan 97)

CoFR EXCEPTION FORM INSTRUCTIONS

Exceptions must be submitted on CoFR Exception Form (SSP Form 4043) to the Readiness Review Secretariat by the beginning of their presentation. All exceptions to a specific endorsement shall be appropriately identified by the alpha designator for the requirement code against which exception is taken. The Readiness Review Secretariat will assign the exception number.

At the end of the review, the Readiness Review Secretariat will provide to the originator a copy of the original exception (signed by the review board Chair). Resolution of the exception, with appropriate signatures, will be placed on this form and returned to the Readiness Review Secretariat for appropriate approval and signature.

1.	EXCEPTION NUMBER	This number (beginning with 001) is assigned by the Review Secretariat for tracking purposes.
2.	ELEMENT AND SERIAL NUMBER	Identify the project or flight element (ET, SSME, SR&QA, etc.) and/or the manufacturer stamped serial number of that element.
3.	STS FLT NUMBER	The assigned flight number.
4.	REQUIREMENT/ DESCRIPTION OF EXCEPTION	A brief statement defining the exception. Identify the requirement against which the exception is being taken (either in Section 8 or the FPPP).
5.	INITIATOR/TITLE	Signature and title of person who initiated this exception.
6.	DATE	Month, day, year of initiator signature.
7.	CONCURRENCE/TITLE	Signature and title of the program element/project manager, NASA or contractor, responsible for the element/task applicable to this exception.
8.	DATE	Month, day, year that manager above signs.
9.	ACTION/ACTIONEE	Define the action and/or assign the actionee.
10.	DUE DATE	Date by which action is due.
11.	REVIEW BOARD CHAIR	Signature of the review board Chair.
12.	DATE	Month, day, year of review board Chair signature.

13.	RESOLUTION OF EXCEPTION	State resolution of the exception.
14.	DATE RESOLVED	Month, day, year action was resolved.
15.	CONTRACTOR MANAGER	Contractor element/project manager signature block, signifying resolution of exception.
16.	DATE	Month, day, year of contractor element/project manager signature.
17.	NASA PROJECT MANAGER	NASA program element/project manager signature block, signifying resolution of exception.
18.	DATE	Month, day, year of NASA program element/project manager signature.
19.	SPACE SHUTTLE PROGRAM	NASA Space Shuttle Program signature signifying approval of resolution of exception.
20.	DATE	Month, day, year of NASA Space Shuttle Program signature.

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FIGURE 5

CoFR EXCEPTION LOG FORM

CoFR EXCEPTION LOG			CoFR REVIEW DATE: STS FLT NO.
REQUIREMENT/ EXCEPTION NUMBER	ELEMENT	DESCRIPTION OF EXCEPTION	DUE DATE

SSP Form 4044 (Bsl Dec 95)

CoFR EXCEPTION LOG FORM INSTRUCTIONS

This log itemizes all exceptions taken against a specific endorsement.

1. CoFR REVIEW DATE	Month, day, year of CoFR review.
2. STS FLT NO.	STS flight number.
3. REQUIREMENT/ EXCEPTION NUMBER	Requirement and exception number as identified on SSP Form 4043.
4. ELEMENT	Element(s) as identified on SSP Form 4043.
5. DESCRIPTION OF EXCEPTION	Description of exception as identified on SSP Form 4043.
6. DUE DATE	Date as identified on SSP Form 4043.

FIGURE 6

REVIEW ACTION ITEM FORM

REVIEW ACTION ITEM			
CONTROL NO.	DATE ASSIGNED	ASSIGNEE(S)	DUE DATE
ACTION:			
RESOLUTION:			
SUBMITTED BY: Assignee Date Assignee Date		APPROVAL: Space Shuttle Program Date	

SSP Form 4032 (Rev Jul 95)

REVIEW ACTION ITEM FORM INSTRUCTIONS

Action items assigned during a readiness review shall be documented on an Action Item Form (SSP Form 4032). These actions will be assigned a control number and due date by the Readiness Review Secretariat. Action items which constrain a milestone will be identified on the form as a “constraint”.

Projects assigned an action will receive from the Readiness Review Secretariat a copy of their action at the conclusion of the review. Closure rationale for all action items will be presented through the daily PRCB prior to the due date. Actionees will place the accepted closure rationale on their copy of the action, obtain the appropriate signature(s), and submit that closure to the Readiness Review Secretariat by the due date.

1. CONTROL NO.	Number assigned by the Review Secretariat to action for tracking purposes (i.e., 66–FRR–001, 59–PMMT–002, 62–ORR–001). NOTE: The control no. is made up of three sections separating each by a (–): – STS Flow Number – Abbreviated Title of Review (ET/SRB, ORR, FRR, PMMT) – Action Item Number within that review; always use three digits (i.e., 001, 002)
2. DATE ASSIGNED	Month, day, year the action is assigned.
3. ASSIGNEE(S)	The element/project(s) to which the action is assigned.
4. DUE DATE	Date or milestone by which the resolution to the action item is due.
5. ACTION	Statement which clearly defines the action. Any action item which constrains the review milestone, will have the word “constraint” placed below the end of the action statement.
6. RESOLUTION	A description which clearly identifies how the action was resolved.
7. SUBMITTED BY	Signature of the assignee(s) and date signed.
8. APPROVAL	NASA Space Shuttle Program signature signifying approval of resolution of action.

FIGURE 7

REVIEW ACTION ITEM LOG FORM

STS– ______

____________________ REVIEW

DATED:

ACTION ITEM LOG

CONTROL NO.	ASSIGNEE(S)	ACTION	C	DUE DATE	CLOSURE DATE

SSP Form 4033 (Rev Apr 99)

C – CONSTRAINT TO MILESTONE

REVIEW ACTION ITEM LOG FORM INSTRUCTIONS

This log itemizes all action items assigned during a specific review. At the top of the form, the five blanks will be filled in with the STS mission number, the title of the readiness review, and the date the review was conducted; i.e.,

STS–65

Flight Readiness Review

Dated: June 23, 1994

1. CONTROL NO.	Number as assigned on SSP Form 4032.
2. ASSIGNEE(S)	The element/project(s) as assigned on SSP Form 4032.
3. ACTION	Statement of the action as it appears on SSP Form 4032.
4. C	This column will contain a C if the action is a constraint to the review milestone.
5. DUE DATE	Due date as assigned on SSP Form 4032.
6. CLOSURE DATE	Month, day, year of Space Shuttle Program approval on Form 4032.

9.0 ACRONYMS AND ABBREVIATIONS

AA	Associate Administrator
ABCL	As–Built Configuration List
ADP	Acceptance Data Package
AFSIG	Ascent Flight Systems Integration Group
ALARA	As Low Below the Limits As is Reasonably Achievable
ALERT	Acute Launch Emergency Reliability Tip
AMAK	Airway Medical Accessory Kit
AOD	Aircraft Operations Division
APD	Area Passive Dosimeter
APM	Associate Program Manager
ASD	Avionic Systems Division
ASE	Airborne Support Equipment
ASO	Avionics and Software Office
ASP	Astronaut Support Person
ASRS	Automated Support Requirements System
BARS	Baseline Accounting and Reporting System
BDC	Baseline Data Collection
BFS	Backup Flight System
BIP	Biomedical Instrumentation Plug
C&T	Communication and Tracking
CAF	Contractor Accountable Function
CAPCOM	Capsule Communicator
CAPS	Corrective Action Problem Summary
CAR	Certification Approval Request
	Component Acceptance Review
	Corrective Action Records
	Corrective Action Request
CCB	Configuration Control Board
	Change Control Board
CCBD	Control Board Directive
CCCD	Crew Compartment Configuration Drawing
CCCR	Crew Compartment Configuration Review
CCK	Contamination Cleanup Kit
CCN	Code Change Notice
CCR	Cargo Compatibility Review
CCTV	Closed Circuit Television
CDR	Critical Design Review
CEE	Crew Escape Equipment

CEIT	Crew Equipment Interface Test
CFE	Contractor Furnished Equipment
CG	Center–of–Gravity
CI	Configuration Inspection
CIAR	Change Implementation Assessment Record
CIL	Critical Items List
CIR	Cargo Integration Review
CITE	Cargo Integration Test Equipment
CMDS	Configuration Management Data System
CMO	Crew Medical Officer
CoFR	Certification of Flight Readiness
	Certificate of Flight Readiness
COQ	Certificate of Qualification
COTS	Commercial Off–the–Shelf
CPCB	Crew Procedures Control Board
CPD	Crew Passive Dosimeter
CPDS	Computer Program Development Specification
CPLC	Crew Participation Load Checkout
CPMP	Crew Procedures Management Plan
CR	Change Request
CSM	Cargo Systems Manual
CTF	Commit–to–Flight
CTSD	Crew and Thermal Systems Division
CV	Configuration Verification
CVAS	Configuration Verification Accounting System
DAP	Digital Autopilot
DAR	Deviation Approval Request
DC&R	Discrepancy Check and Report
DCAS	Defense Contract Administration Service
DCN	Drawing Change Notice
DCR	Data Change Request
DD	Description Document
DDMS	Department of Defense Manned Space Flight Support Office
DFL	Decommutator Format Load
DFRC	Dryden Flight Research Center
DICB	Daily Integration Control Board
DICBD	Daily Integration Control Board Directive
DN	Discrepancy Notice
DOD	Department of Defense
DOL	Day–of–Launch

DOLILU	Day–of–Launch I–Load Update
DOLILU II	DOLILU Version 2
DOSS	DOLILU Operations Support System
DR	Discrepancy Report
DRD	Design Requirements Document
DSO	Detailed Supplementary Objective
DTO	Detailed Test Objective
	Developmental Test Objective
EAR	Element Acceptance Review
ECL	Engineering Configuration List
ECLSS	Environmental Control and Life Support System
ECP	Engineering Change Proposal
EEE	Electronic, Electrical, Electromechanical
EIS	End Item Specification
EMC	Electromagnetic Compatibility
EMCC	Emergency Mission Control Center
EME	Electromagnetic Effects
EMI	Electromagnetic Interference
EMK	Emergency Medical Kit
EMU	Extravehicular Mobility Unit
EO	Engineering Order
EOM	End of Mission
EOR	EVA Operations Room
ESERP	EVA Support Equipment Review Panel
ET	External Tank
ETA	Environmental Test Article
EVA	Extravehicular Activity
EVAAT	EVA Assessment Team
FAR	Failure Analysis Report
FAWG	Flight Assignment Working Group
FCE	Flight Crew Equipment
FCOD	Flight Crew Operations Directorate
FCT	Flight Control Team
FDRD	Flight Definition and Requirements Directive
FDF	Flight Data File
FEC	Field Engineering Change
FEM	Finite Element Model
FEPC	Flight Equipment Processing Contractor
FIAR	Failure Investigation Analysis Report
FIM	Flight Integration Manager
FMA	Flight Margins Assessment

FMEA	Failure Modes and Effects Analysis
FOR	Flight Operations Review
FPP	Flight Preparation Process
FPPP	Flight Preparation Process Plan
FPRV	Flight Product Review Verification
FPSR	Flight Planning and Stowage Review
FRCB	Flight Rules Control Board
FRD	Flight Requirements Document
FRF	Flight Readiness Firing
FRR	Flight Readiness Requirement
	Flight Readiness Review
FRV	Flight Readiness Verification
FSSR	Functional Subsystem Software Requirements
FSW	Flight Software
FTP	Flight Techniques Panel
FTSOD	Flight Test and Supplementary Objectives Document
GFE	Government Furnished Equipment
GIDEP	Government–Industry Data Exchange Program
GLS	Ground Launch Sequencer
GN&C	Guidance, Navigation, and Control
GOAL	Ground Operations Aerospace Language
GOR	Ground Operations Review
GPC	General Purpose Computer
GSE	Ground Support Equipment
HAL	High–Order Assembly Language
HAR	Hazardous Analysis Report
HAW	Hazard Analysis Worksheet
HCS	Hardware Certification Sheet
HEAR	Hardware Element Acceptance Review
HEDS	Human Exploration and Development of Space
HMST	Hazardous Materials Summary Table
HR	Hazard Report
HRPPC	Human Resources Policies and Procedures Committee
HSP	Health Stabilization Program
HSSSI	Hamilton Sundstrand Space Systems International, Inc.
HTDs	HEADS Technology Demonstrations
I–Load	Initial Computer Data Load Initialization Load
ICB	Integration Control Board
ICBD	Integration Control Board Directive
ICD	Interface Control Document

ICHA	Integrated Cargo Hazard Assessment
IDR	Interim Discrepancy Report
IFA	In–Flight Anomaly
ILC	Integrated Load Checkout
IP	Integration Plan
IPR	Interim Problem Report
IPS	Integrated Planning System
IPT	Integrated Product Team
IRB	Institutional Review Board
IRD	Information Requirements Document
	Installation Requirements Document
IRN	Interface Revision Notice
ISS	International Space Station
ISSP	International Space Station Program
ITF	Integrated Training Facility
IV&V	Independent Verification and Validation
IWG	Interface Working Group
JAD	Joint Agreement Document
JIS	Joint Integrated Simulation
KICS	KSC Integrated Control Schedule
L&L	Launch and Landing
L–2	Launch Minus Two
LAN	Local Area Network
LC	Launch Complex
LCC	Launch Commit Criteria
LCN	LCC Change Notice
LES	Launch and Entry Suit
LMIS	Lockheed Martin Information Systems
LPS	Launch Processing System
LRR	Launch Readiness Review
LRU	Line–Replaceable Unit
LSFR	Launch Site Flow Review
LSRR	Launch Site Requirements Review
LSS	Launch Support System
	Life Support System
LSSP	Launch Site Support Plan

M&P	Materials and Processes
M/OD	Meteoroid and Orbital Debris
MAPTIS	Materials and Processes Tracking Information System
MAR	Mid–deck Accommodations Rack
MBK	Medication and Bandage Kit
MCC	Mission Control Center
MCPP	Mission Configuration Product Plan
MCR	Master Change Record
MDD	Mate–Demate Device
MDF	Mission–Definition
MECSLSI	Mission Equipment Cargo Support Launch Site Installation
MEDOP	Medical Extended Duration Orbital Pack
MEL	Minimum Equipment List
MER	Mission Evaluation Room
MET	Mission Elapsed Time
MIL	Mandatory Instrumentation List
MIP	Mandatory Inspection Point
	Memory Integration Plan
	Mission Integration Plan
MIT	Mishap Investigation Team
MIUL	Material Identification and Usage List
MLP	Mobile Launch Platform
	Mobile Launcher Platform
MMT	Mission Management Team
MMU	Mass Memory Unit
MOB	Medical Operations Branch
MOC	Mission Occurrence
MOD	Mission Operations Directorate
MORR	Medical Operations Readiness Review
MPS	Main Propulsion System
MPT	Mission Processing Team
MR	Material Review
MRB	Material Review Board
MRCS	Mission Requirements Control System
MSI	Maintenance Significant Item
MUA	Material Usage Agreement
MUD	Mission–Unique Drawing
MUPP	Mission–Unique Processing Plan
MVP	Master Verification Plan
NCD	Non–Conformance Document
NCR	Non–Compliance Report

NEWS	New Engineering Work Status
NHB	NASA Handbook
NSRS	NASA Safety Reporting System
NSW	Non–Standard Work
OAFGSS	Orbiter Air Fuselage Gas Sampler System
OBS	Operational Bioinstrumentation System
OCTF	One–Cycle–to–Flight
ODF	Operations Data File
ODRC	Orbiter Data Reduction Complex
OI	Operational Increment
OIR	Open Item Review
OISR	Open Item Status Report
OJT	On–the–Job Training
OMDP	Orbiter Maintenance Down Period
OMI	Operations and Maintenance Instruction
OMP	Operations and Maintenance Plan
OMRS	Operations and Maintenance Requirements and Specifications
OMRSD	OMRS Document
OPF	Orbiter Processing Facility
OPIRS	Orbiter/Payload Interface Requirements Summary
OPR	Office of Primary Responsibility
OPTWG	Orbiter Photographic/Television Working Group
OR	Operations Review
ORR	Operational Readiness Review
OTS	Off–the–Shelf
	OMI Tracking System
OV	Orbiter Vehicle
OVEI	Orbiter Vehicle End Item
PADS	Problem Action Data System
PAO	Public Affairs Office
PAR	Prelaunch Assessment Review
PAS	Problem Assessment System
PASS	Primary Avionics Software System
PCISAR	Payload/Cargo Integration Safety Assessment Report
PD	Procedure Deviation
PDA	Pre–Delivery Acceptance
PDR	Preliminary Design Review
PDTR	Pre–Delivery Transfer Review
PEAT	Payload Element Assignment Table
PFA	Pre–Flight Assessment
PFDF	Payload Flight Data File

PGOC	Payload Ground Operations Contractor
PGSC	Payload and General Support Computer
PIA	Pre–installation Acceptance
PICS	Payload Integrated Control Schedule
PIH	Payload Integration Hardware
PIM	Payload Integration Manager
PIP	Payload Integration Plan
PMMT	Prelaunch Mission Management Team
PMP	*Project Management Plan
PMRB	Program Material Review Board
PMSS	Preventative Maintenance Scheduling System
POC	Portable Onboard Computer
POCA	Portable Onboard Computer Adjunct
POCC	Payload Operations Control Center
POWG	Payload Operations Working Group
PR	Problem Report
PRACA	Problem Reporting and Corrective Action
PRCB	Program Requirements Control Board
PRCBD	Program Requirements Control Board Directive
PRD	**Program Requirements Document Payload Requirements Document Passive Radiation Dosimeter
PRR	Payload Readiness Review
PRT	Problem Review Team
PSRP	Payload Safety Review Panel
PTRS	Project Technical Requirements Specification
Q&RA	Quality and Reliability Assurance
QA	Quality Assurance
RAM	Requirements Allocation Matrix
RAR	Rocketdyne Action Request
RASS	Release Authorization Signature Sheets
RCC	Reinforced Carbon–Carbon

*NOTE: PMP guideline per JSC 61100, Project Management Guide, Appendix A.3 authorized on 1/31/96 by PRCBD S060617 replaced PMP guidelines per JSC 26287, Project Management Plan (PMP) Guideline

**NOTE: PRD types include as follows:

1. JSC PRDs per JSC 23540, Program Requirements Document (PRD) Guidelines
2. Backup Flight System (BFS) PRDs
3. SSP PRDs per NMI 8610.10B, Management of Operational Support Requirements for Manned Flight Missions, (SSP L&L PRD, SSP Flight PRD, and SSP Orbital PRD)

RCN	Requirements Change Notice
RCP	Radiation Constraints Panel
RCS	Reaction Control System
RDL	Radiation Dosimetry Laboratory
RECON	Reconfiguration
RF	Radio Frequency
RID	Review Item Disposition
RMO	Resident Manager’s Office
RMRS	Repetitive Maintenance Recall System
RMS	Remote Manipulator System
RSRM	Redesigned Solid Rocket Motor
	Reusable Solid Rocket Motor
S&E	Science and Engineering
S&MA	Safety and Mission Assurance
SR&QA	Safety, Reliability and Quality Assurance
SS&MA	Shuttle Safety and Mission Assurance
S/AD	Specification and Assembly Drawing
S/N	Serial Number
SAA	System Assurance Analysis
SAIL	Shuttle Avionics Integration Laboratory
SAN	Software Authorization Notice
SAR	Safety Analysis Report
	Special Action Requirements
SASCB	Shuttle Avionics Software Control Board
SASR	Shuttle Avionics Systems Review
SCA	Shuttle Carrier Aircraft
SCAN	Shuttle Connector Analysis Network
SCMS	Shuttle Change Management System
SCR	Software Change Request
SDRD	Specific Design Requirements Document
SDT	Shuttle Data Tape
SFOC	Space Flight Operations Contractor
SIAP	System Integrity Assurance Plan
SIM	Simulation
SIP	Standard Integration Plan
SLF	Shuttle Landing Facility
SLSD	Space and Life Sciences Directorate
SM	Systems Management
SMACAR	Safety and Mission Assurance Certification Approval Request
SMR	Senior Management Review
SMRB	Senior Management Review Board
SMRC	Scientific Merit Review Committee

SMS	Shuttle Mission Simulator
SOLOC	Shuttle Orbiter Logistics Operations Contractor
SOMS	Shuttle Orbiter Medical System
SOW	Statement of Work
SPAN	Spacecraft Analysis
SPC	Shuttle Processing Contractor
SPF	Software Production Facility
SPI	Standard Practice Instruction
SPP	Standard Practices and Procedures
SRAG	Space Radiation Analysis Group
SRB	Solid Rocket Booster
SRR	Software Readiness Review
SSC	Stennis Space Center
SSME	Space Shuttle Main Engine
SSMEC	Space Shuttle Main Engine Controller
SSP	Space Shuttle Program
SSRP	Systems Safety Review Panel
SSS	Space Shuttle System
SSV	Space Shuttle Vehicle
SSVEO	Space Shuttle Vehicle Engineering Office
STA	Shuttle Training Aircraft
STS	Space Transportation System
SVS	Space Vision System
TACCS	Time, Age, Cycle Control System
	Time/Age–Life/Cycle Control System
TAL	Transatlantic Abort Landing
TBD	To Be Determined
TCDT	Terminal Countdown Demonstration Test
TCTI	Time Compliance Technical Instruction
TD	Technical Directive
TDDP	Trajectory Design Data Package
TDRSS	Tracking and Data Relay Satellite System
TELCS	Thermoelectric Liquid Cooling System
TFL	Telemetry Format Load
TIM	Technical Interchange Meeting
TIPS	Tile Information Processing System
TLD	Thermoluminescent Dosimeter
TO	Technical Order
TOP	Technical Operating Procedure
TPS	Test Preparation Sheet
TRP	Technical Review Panel
TRR	Test Readiness Review
TT&E	Test, Teardown and Evaluation

UA	Unexplained Anomaly
UAB	Unexplained Anomaly Board
UCR	Unsatisfactory Condition Report
USAF	United States Air Force
VAB	Vehicle Assembly Building
VAR	Verification Acceptance Review
VECB	Vehicle Engineering Control Board
VITO	Vehicle Integration Test Office
VOC	Vehicle–Occurrence
VU	Vehicle Utility
WADS	Work Authorization Documentation System
WETF	Weightless Environment Test Facility
WSTF	White Sands Test Facility

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APPENDIX A

SPACE SHUTTLE VEHICLE ENGINEERING OFFICE ORBITER FLIGHT PREPARATION PROCESS PLAN

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CONTENTS - Orbiter Flight Preparation Process Plan

NSTS 08117

CONTENTS - Flight Crew Equipment Flight Preparation Process Plan

NSTS 08117, APPENDIX A – ATTACHMENT I

FIGURES - Flight Crew Equipment Flight Preparation Process Plan

NSTS 08117, APPENDIX A – ATTACHMENT I

CONTENTS - Avionics and Software Flight Preparation Process Plan

NSTS 08117, APPENDIX A – ATTACHMENT II

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APPENDIX A

SSVEO FLIGHT PREPARATION PROCESS

1.0 INTRODUCTION

This appendix and attachments address the SSVEO FPP, which includes mission–specific analysis, hardware/system verification, and anomaly resolution. The process culminates in a thorough FRR and CoFR signed by the SSVEO and the contractor. This process complies with the Shuttle FPP requirements documented in NSTS 08117, Space Shuttle Requirements and Procedures for Certification of Flight Readiness. The SSVEO processes required to ensure the implementation of the applicable Space Shuttle Program requirements are described in this document.

Appendix A describes the Orbiter FPP and is followed by two attachments, which represent other essential elements comprising the FPP performed by the SSVEO. Attachment I describes the Flight Crew Equipment and RMS/SVS FPP, and Attachment II describes the Avionics and Software FPP. For more specific information regarding each discipline, refer to the respective attachment.

Appendix R, Space Flight Operations Contractor Flight Preparation Process Plan, delineates the processes and products the SFOC is responsible to develop, review, and certify for flight. It also identifies the processes in which the SFOC participates to ensure flight readiness.

2.0 OBJECTIVES

The objectives of this document are to define the scope of activities required to ensure that the Orbiter, flight crew equipment, Remote Manipulator System (RMS), Space Vision System (SVS), and flight software and proposed mission are compatible; that System Integrity Assurance Plan (SIAP) requirements are met for each mission; that management visibility exists relative to significant trends in critical systems; and that a team approach to readiness exists throughout the Space Shuttle Program.

3.0 SCOPE

This document is applicable to all items of hardware, analysis, and software for which the NASA Johnson Space Center (JSC) SSVEO is responsible.

4.0 APPLICABLE DOCUMENTS

The following NSTS Program documents are applicable to the requirements contained in this document. Most of these documents are under the control of the Shuttle Program Requirements Control Board (PRCB) and are subject to periodic updates. The specific issue of each document used to derive the Orbiter Flight Preparation Process Description Document requirements is indicated. Updates to these requirements will require evaluation for possible changes to this document.

NSTS 07700 Volume III Revision R April 6, 1995	Space Shuttle Flight Definition and Requirements Directive (current issue, including all changes)
NSTS 07700 Volume VIII Revision D January 7, 1993	Space Shuttle Operations (current issue, including all changes)
NSTS 07700 Volume XI Revision B May 14, 1993	System Integrity Assurance Program (SIAP) Plan (current issue, including all changes)
NSTS 08117 Revision L December 13, 1995	Space Shuttle Requirements and Procedures for Certification of Flight Readiness (current issue, including all changes)
NSTS 08126 Revision G September 29, 1995	Space Shuttle Problem Reporting and Corrective Action (PRACA) System Requirements (current issue, including all changes)
NSTS 08203 Revision A July 15, 1987	Technical Operating Procedures (TOPs) Review Implementation Plan
NSTS 08271 Revision A January 20, 1994	Space Shuttle Flight and Ground Software Verification and Validation Requirements (current issue, including all changes)
NSTS 16007 Revision F May 1, 1992	Shuttle Launch Commit Criteria and Background Document (current issue, including all changes)
NSTS 17462–(XX)	Flight Requirements Document – STS–XX as issued for each mission)
NSTS 22206 Revision D December 30, 1993	Requirements for Preparation and Approval of Failure Modes and Effects Analysis (FMEA) and Critical Items List (CIL) (current issue, including all changes)

NSTS 22254 Revision B December 30, 1993	Methodology for Conduct of Space Shuttle Program Hazard Analysis (current issue, including all changes)
JSC 17481 Revision A September 1984	Safety Requirements Document for JSC Space Shuttle Flight Equipment

5.0 ORBITER FLIGHT PREPARATION PROCESS

5.1 PROCESS DESCRIPTION

The process begins with the baselining of the Flight Definition and Requirements Directive (FDRD) and ends with the final commit–to–launch of the Orbiter. This plan addresses the analyses required to verify Orbiter System(s) readiness for every mission, and the processes leading to the determination that the hardware and software are ready to support the mission. For vehicle and hardware responsibilities transitioned to SFOC, the SSVEO utilizes insight, surveillance, and audit of the SFOC's FPP activities to determine Orbiter readiness. This document also provides for an evaluation of the integrity of the Orbiter System(s) and if required, a mission–specific risk assessment. The SSVEO FPP also involves participation in various SFOC readiness reviews and includes the preparation of Flight Readiness Statements prior to the Orbiter Processing Facility (OPF) Rollout Review and the FRR.

5.2 ORBITER SYSTEMS/SUBSYSTEMS RESPONSIBILITIES

5.2.1

The Orbiter System(s) Flight Preparation Process ensures that the following Orbiter–related requirements have been met:

a. Design requirements, analyses, assessments, and performance capabilities and constraints have been defined in appropriate documents and released/ furnished to the implementing organizations.

b. Approved changes to flight hardware have been implemented.

c. Pertinent data from previous STS missions have been analyzed to ensure that specified performances were achieved and that the results support current mission requirements.

d. Orbiter/payload hardware interfaces are compatible.

e. The vehicle mass properties associated with the mission are calculated to be within established limits.

f. Certification requirements pertaining to flight hardware have been satisfied.

g. The vehicle configuration complies with the released engineering, including time, age, and life–cycle requirements.

h. Changes, waivers, and exceptions to the OMRSD, File III, File IV, and File IX, have been documented and approved.

i. Waivers to the Orbiter Vehicle End Item (OVEI) specification requirements have been documented and approved.

j. Flight and ground hardware failures/discrepancies and unexplained anomalies, experienced during the turnaround flow, have been assessed, and none constitute a flight constraint.

k. In–flight anomalies from previous flights of all vehicles have been assessed, and none constitute a flight constraint.

l. Corrective Action Records (CARs) have been assessed, and there are no issues which could constrain flight.

m. Government–Industry Data Exchange Program (GIDEP) ALERTs have been reviewed and present no constraint to flight.

n. Potential vehicle safety issues and hazards have been assessed, and none pose a constraint to flight.

o. Critical Items List (CIL) retention rationale for affected hardware has been accepted.

p. Exceptions and action items from previous reviews have been assessed, and none constitute a flight constraint.

q. Open work and/or actions have been planned and scheduled.

5.2.2

The FPP and associated activities required to commit to the readiness milestone fall within one of the following categories:

a. Hardware not transitioned to SFOC

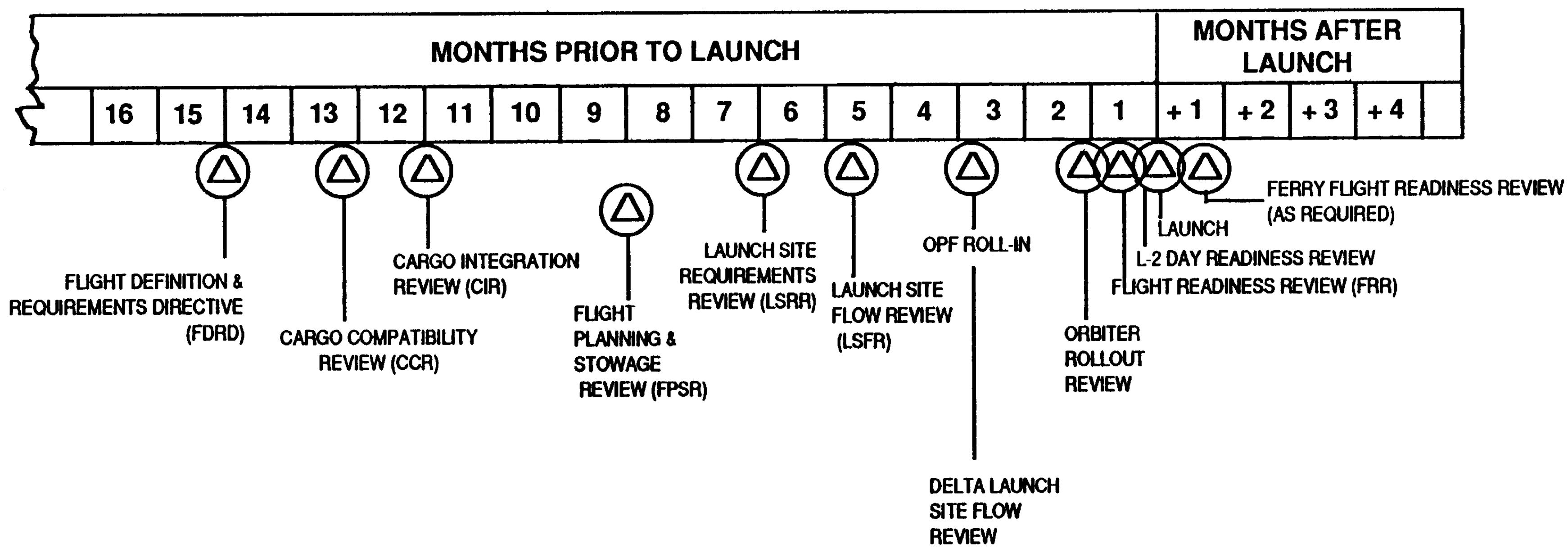
1. Orbiter performance analysis
2. Hardware readiness
3. Technical requirements processing and oversight
4. Safety, Reliability, and Quality Assurance readiness

b. SFOC responsibilities (SSVEO insight, audit, and surveillance)

Descriptions of these activities are set forth in Section 6.0 of this document, in Appendix R, and in PDP 3.2–MV–FRR, Product Development Plan for Orbiter Flight Readiness.

FIGURE A–1

MAJOR MILESTONES IN THE ORBITER FLIGHT PREPARATION PROCESS



5.3 ORBITER FLIGHT PREPARATION MILESTONE REVIEWS

The SSVEO participates in various milestone reviews to ensure that the projected mission can be fully supported. For SFOC responsibilities in the Orbiter FPP, the SSVEO is notified of any issues identified through SFOC participation in milestone reviews.

5.3.1 Cargo/Payload Assessment

The SFOC participates in each of the following reviews to determine if any special hardware support will be needed to accommodate the cargo/payload(s) being manifested and to assure their compliance with the pertinent Orbiter ICDs and established performance envelopes:

a. Cargo Compatibility Review (CCR)

b. Cargo Integration Review (CIR)

5.3.2 Launch Site Requirements Review (LSRR)

SSVEO and SFOC participation in this review assures the proper identification and definition of Orbiter modifications to be accomplished during that flow. Activities include the identification of required engineering documentation and the hardware (including Line–Replaceable Units [LRUs], modification kits, etc.) needed to support the Orbiter/payload modification/changes. It is during this review that specific/required nonstandard tasks, in addition to those defined in NSTS 08171, are identified and scheduled.

5.3.3 Launch Site Flow Review (LSFR)

SSVEO and SFOC participation in this baselining review assures that required hardware will be available and that it can be delivered in time to support work schedules. Changes approved since the LSRR are addressed and planned for during this review. Particular attention is given to assuring that vehicle configuration is identified and control is maintained during the flow process.

5.3.4 Delta Launch Site Flow Review

The SSVEO and SFOC actively participates in the rebaselining effort associated with addressing and planning for impacts caused by in–flight anomalies, in–flight checkout, post–flight inspections, and ferry activities.

5.3.5 Orbiter Rollout Review

The SSVEO plays a primary role in determining that the vehicle is ready to leave the OPF, participating in the rigorous internal SFOC reviews of all Orbiter subsystems/ systems conducted prior to the program–level OPF Rollout Review to determine the completeness and readiness of the hardware. These reviews provide the confidence that there are no constraints to moving the vehicle to the Vertical/Vehicle Assembly Building (VAB) for subsequent mating and testing.

5.3.6 Flight Readiness Review

The SSVEO and SFOC conduct pre–FRR reviews and prepare and present relevant documentation and data in sufficient detail to assure that flight hardware discrepancies, anomalies, and launch constraints have been fully evaluated and resolved. A Flight Readiness Statement is signed by the NASA and contractor at the conclusion of this review. The SSVEO and SFOC present flight readiness material at the FRR as required. At the conclusion of the Level I FRR, a CoFR is signed by the SSVEO and contractor.

5.3.7 Prelaunch Mission Management Team Review

The SSVEO participation in the PMMT Review includes:

a. Closure status of any actions assigned at the FRR

b. Resolution of any constraints to launch identified at the FRR

c. Resolution of all problems and anomalies, including any identified as unresolved at the FRR and any encountered since the FRR

d. Resolution and closure of all open items/work identified at the FRR

5.3.8 Ferry FRR

The SSVEO supports the Ferry FRR by assuring that any constraints to Orbiter ferry have been identified and resolved, that hardware nonconformances which would affect ferry flight have been resolved or closed, that in–flight anomalies have been assessed and do not constrain Orbiter ferry, and that the flight vehicle and ferry flight hardware configurations are properly documented and will support ferry flight.

6.0 FPP ACTIVITIES

The SSVEO Orbiter FPP consists of activities that support a readiness evaluation of hardware not transitioned to SFOC and insight, audit, and surveillance activities that support a readiness evaluation of SFOC performed tasks and responsibilities. For each STS milestone review, contractor and NASA JSC briefings are reviewed, and Flight Readiness Statements are submitted to the responsible NASA JSC organization for approval. The specific content/description of the entire series of Flight Readiness Statements by subsystem and area of responsibility is defined by PDP 3.2 MVP–FRR.

The following sections describe general review activities to be performed by NASA or SFOC, as a function of primary responsibility.

6.1 ORBITER PERFORMANCE ANALYSIS

6.1.1 Objective

The objective of Orbiter performance analysis activities are to determine, execute, document, and certify the analyses required to ensure that the Orbiter is capable of supporting the specific Space Shuttle flight requirements associated with a given mission.

FIGURE A–2 (DELETED)

FIGURE A–3 (DELETED)

6.1.2 Evaluation Considerations

Specific areas are evaluated to determine the vehicle's readiness to support each mission. These assessments are performed when envelopes or constraints are violated to assure the following:

a. The Orbiter is compatible with the specification and mission requirements applicable to the upcoming flight.

b. The associated systems/subsystems work properly with other systems/subsystems.

c. The functions supplied by other systems/subsystems are properly received.

d. Required functions are properly provided to other systems/subsystems.

e. Any interference between systems/subsystems has been resolved (functional/structural, etc.).

f. The primary and backup software are compatible with the current hardware configuration and will support flight.

g. The mission environments, including abort modes, are within the demonstrated or assessed capability of the systems/subsystems.

h. I–Loads are acceptable for flight.

i. Issues, such as placards, restrictions, risks, etc., have been adequately documented and coordinated.

j. Orbiter/payload interfaces are compatible.

k. There are no flight safety issues and/or risks requiring resolution.

l. There are no additional interface coordination/verification considerations requiring attention.

m. The mass properties associated with the mission are within established limits.

6.1.3 Orbiter Performance Assessments

Orbiter performance assessments take particular note of the areas of the mission which might involve additional risk due to unique mission requirements. Examples of this could be certain abort modes, Extravehicular Activities (EVAs), RMS deployment of large payloads, on–orbit assembly of payload components, unusual entry crossrange requirements, etc. Specific assessments are as follows:

6.1.3.1 Verification that the Planned Flight is within Certified Limits

If the certification database is shown to have been violated, a mission–specific assessment is performed. This includes an assessment to evaluate the potential risk of an Orbiter subsystem capability exceedance. Based on the mission plan, the following tasks are performed as applicable:

a. LCC changes are reviewed and assessed for flight compatibility.

b. Pertinent envelopes, identified in the current NSTS 08934, Space Shuttle Operational Data Book, Volume V, Orbiter Flight Capability, Volume VIII, Orbiter Ascent Structure Envelopes, are compared with the flight plan and are verified and certified.

c. A mission–specific analysis is accomplished to verify capability when mission design for ascent, on orbit, entry, or landing may not be within certified Orbiter flight capability envelopes.

d. Orbiter flex stability is verified to assure that it is within the certified Orbiter flight capability.

e. Planned Orbiter on–orbit thermal conditions are verified to assure that they are within the certified Orbiter flight capability.

6.1.3.2 Confirmation of System Performance

Orbiter system/subsystem performance is confirmed by analyzing post–flight data from prior missions, by analyzing and resolving abnormal performance data derived during vehicle flow processing, test and checkout and by analyzing and resolving SAIL testing issues. These system performance analyses address the following:

a. Identification of constraints for flight, which are scheduled for resolution in time to support the flight

b. Evaluation and documentation of problems, unexplained anomalies, and IFAs to assure that they are resolved in time to support vehicle readiness for flight

c. Review of significant differences from previous flights and the incorporation of changes into applicable documents

6.1.3.3 Weight and Balance

Configuration changes are assessed to determine their net impact on the mass properties of the vehicle. The mass properties database is validated using data acquired during a weight and balance test conducted on the Orbiter vehicle per OMRSD. These data, coupled with payload/cargo mass properties data, are used to calculate the sequential mass properties for each mission, to ensure that the weight and Center-of-Gravity (CG)of the launch, on–orbit, landing, and turn–around configurations of the vehicle are within established limits.

6.2 HARDWARE FLIGHT PREPARATION PROCESS ACTIVITIES

6.2.1 Objective

The objective of these activities is to ensure that all Orbiter hardware systems/subsystems/LRUs and associated software meet the mission design, performance, and safety requirements. For hardware systems/subsystems/LRUs that are the responsibility of the SFOC, the SSVEO fulfills this responsibility through insight, audit, and surveillance.

6.2.2 Process

Responsible engineering functions compare the system, subsystem, assembly, or component designs to the mission requirements (including both the basic and derived requirements) to assure that the design meets the mission specification. Where an existing design does not support the mission and the mission cannot be modified, additional verification may be required or the hardware may require modification. Where requirements are derived, methodology and rationale are provided to support the results.

The activities associated with determining hardware readiness fall into seven major categories:

a. Configuration

b. Documentation

c. Age/life status

d. Interfacing items

e. Subsystem requirements

f. Operating regimes

g. Vehicle processing

Each of these categories has one or more specific areas of concern which are addressed (per an established FRS attachment) prior to the OPF Rollout and FRRs of each vehicle.

6.2.3 Evaluation Considerations

Each responsible engineering function addresses, as a minimum, the following as they pertain to their individual and collective system/subsystem:

a. New design requirements and/or derived requirements, created by specific mission requirements, have been documented and verified.

b. Effects of failures have been determined, are understood, and do not constrain the planned mission.

c. Failures, repairs, teardown analysis results, and operational data have been evaluated to identify significant trends (significant trends in critical LRUs are specifically addressed) and procedures are in place to assure that required actions have been instituted.

d. Documented hardware failures have been submitted, as required, for closure.

e. ALERTs which have occurred since the last mission review do not impact the mission.

f. Waivers have been analyzed to determine if they are affected by the mission requirements.

g. Analyses or assessments relating to mission–unique environmental conditions (temperature, vibration, etc.) have been performed to determine if they affect requirements, design, or procedures.

h. Previous placards on the Orbiter have been examined to ascertain if they are still required.

i. Changes to the baseline OMRSD requirements (files 3, 4, and 9) generated in response to new hardware installation, problem resolutions, flow enhancements, and/or waiver avoidances.

j. Certification of new hardware and vehicle modifications including the extension of limited certifications.

6.2.4 Mission Assessment

Each responsible engineering function conducts a mission assessment, as part of the Orbiter FPP. Information is assembled from various sources to provide an objective evaluation of any risks which might be associated with the planned mission. The following areas are specifically addressed:

a. Mission requirements which might affect the baseline assessment (evaluated for increased or decreased risk)

b. Hardware modifications including supporting data such as FMEA/CIL, hazard evaluations, and certification

c. Hardware/software configuration changes with respect to mission requirements

d. Orbiter hardware/software element failures and corrective actions

6.3 TECHNICAL REQUIREMENTS REVIEW

6.3.1 Flight Hardware Certification

The certification status of each vehicle's flight hardware is continuously monitored to assure that there are no open certification requirements which could constrain flight. The process includes identifying changes in Orbiter hardware/processes which require the updating of certification documentation and the preparation, processing, submittal, and tracking of required data to ensure that the submittals are approved in time to support the mission.

6.3.2 Operations and Maintenance Requirements and Specifications Document

Changes to the baselined Orbiter OMRSD requirements (Files II, III, IV, and IX), generated in response to new hardware installations, problem resolutions, flow enhancements, and/or waiver avoidance, are evaluated to assure that none pose an impact to the vehicle or flight safety, and that they are documented on RCNs, which are tracked from proposal through program–level approval (Vehicle Engineering Control Board [VECB]).

Waivers/exceptions to the baselined OMRSD requirements, which may be required during the turnaround flow of a given vehicle, are documented and taken to the VECB for approval. All OMRSD requirements documentation is fully evaluated to assure that the changes neither compromise the safety of the vehicle nor impact the planned mission.

6.3.3 Materials and Processes

All changes to Orbiter flight hardware or new flight hardware designs are assessed to determine that the materials and/or processes associated with the changes, or defined on Material Usage Lists, will not compromise the safety of the crew or the vehicle. Changes to previously certified flight hardware are evaluated to ensure that the certification has not been adversely affected by proposed material or process changes. Critical process changes are presented for approval at the VECB and reviewed as part of the SFOCs FRRs.

6.4 SAFETY, RELIABILITY, AND QUALITY ASSURANCE

6.4.1 Objectives

The objectives associated with the Safety, Reliability, and Quality Assurance (SR&QA) functions are to perform independent assessments of changes to the Orbiter hardware/ software, processes or operations, and previous anomalies/problems in order to verify that it is safe for the crew and the Orbiter to fly.

6.4.2 Process – Safety

Safety personnel conduct risk assessments pertaining to the above–noted changes as they relate to the baselined accepted risks, open or controlled hazards, and/or to evaluate newly identified safety concerns pertaining to both the crew and the Orbiter. The process for any given mission begins with the release of the Flight Requirements Document and continues until launch.

6.4.3 Process – Reliability

Changes in the areas noted above are assessed to determine whether they have an adverse impact on the established reliability baselines for Orbiter hardware. The FPP reliability assessment specifically addresses any reliability issues which may arise from Corrective Action Record (CAR) close–outs and those changes which could potentially impact the FMEA/CIL. Modifications to Orbiter hardware are evaluated to determine if changes are required in the FMEA/CIL.

6.4.4 Process – Quality Assurance

6.4.4.1 Product Assurance

Product assurance activities involve various independent reviews and audits of hardware documentation. These are conducted to assure that all open issues have been properly identified and documented, that they are being worked, and that they are closed prior to launch.

6.4.4.2 Configuration Management

The Configuration Verification Accounting System (CVAS) is the data base system by which the as–designed versus the as–built configurations of the vehicles are tracked. The database is constantly updated during the FPP and is queried prior to the OPF Rollout and the FRR reviews to determine that there are no configuration constraints to those milestones.

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ATTACHMENT I

FLIGHT CREW EQUIPMENT
FLIGHT PREPARATION PROCESS PLAN

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ATTACHMENT I

FLIGHT CREW EQUIPMENT
FLIGHT PREPARATION PROCESS

1.0 INTRODUCTION

The Flight Crew Equipment Management Office FPP requires a Flight Crew Equipment Flight Readiness Statement from the following organizations: Avionic Systems; Crew and Thermal Systems; Medical Sciences; Flight Crew Support; Propulsion and Power; Structures and Mechanics; Solar Systems; Safety and Mission Assurance; Automation and Robotics; SFOC; and the Astronaut Office. The above listed divisions are responsible for a list of hardware unique to Flight Support Equipment. The Certification of Flight Readiness (CoFR) agenda is comprised of disciplines from the Flight Crew Equipment Management Office and the Remote Manipulator System (RMS) Integration Office. Each respective organization shall provide a Flight Crew Equipment Readiness Endorsement that certifies that the completed activities and remaining Open Work required for flight of the Space Shuttle Vehicle, flight crew, and payloads, as defined by baselined SSP requirements and documentation, have been reviewed and approved.

Each respective organization is responsible for a select number of requirement codes and their endorsement certifies readiness for a particular mission, contingent on closeout of any exceptions noted on Figure A.I–1, which is signed after the Flight Crew Equipment Flight Readiness Review (FRR), (reference Figure A.I–1).

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FIGURE A.I–1

FLIGHT CREW EQUIPMENT FLIGHT READINESS STATEMENT

RESPONSIBILITY	NASA	DATE
Audio System, Video System, PGSC, Standard Switch Panels, RF, Printers a thru r	Avionic Systems Division	
Crew Escape Equipment, Cabin Air Cleaner a thru r	Crew and Thermal Systems Division	
Medical Equipment, Medical DSOs a thru r	Medical Sciences Division	
Food, Clothing, Cameras, Treadmill, SORG, Crew Equipment a thru r	Flight Crew Support Division	
OAFGSS, Batteries a thru r	Propulsion and Power Division	
SFOC FCE/EVA d, k, p thru s		
Radiation Measurement Devices a thru s	Solar System Exploration Division	
Flight Data Files a thru r	Mission Operations Directorate Operations Chief	
Materials a thru r	Manufacturing, Materials, and Process Technology Division	
Space Shuttle SR&QA a thru r	Shuttle Safety and Mission Assurance	
Shuttle Remote Manipulator System a thru r	Automation, Robotics and Simulation Division	

NOTE: The following requirement codes are applicable to the Flight Crew Equipment Flight Readiness Review process.

2.0 FLIGHT CREW EQUIPMENT

The Flight Crew Equipment Management Office FPP includes, but is not limited to, the following responsibilities:

a. Any exceptions listed from prior reviews, or actions from applicable readiness reviews, which constrain flight readiness, are resolved.

b. Constraints to flight readiness are identified and scheduled for completion or resolution.

c. Waivers, deviations, exceptions, and restricted hardware dispositions are acceptable for flight readiness.

d. Problems, unexplained anomalies, and In–Flight Anomalies (IFAs) are evaluated and documented as acceptable for flight readiness.

e. Personnel actively participating in hardware processing are trained and/or certified.

f. Flight hardware requirements are defined in released engineering and documentation.

g. “As–built” flight element configuration satisfies the released requirements and engineering.

h. Flight hardware certification is complete.

i. Flight hardware is within time, cycle, age life, interval inspection, and maintenance requirements.

j. Flight hardware discrepancies and problems are reviewed and dispositioned with remedial action or approved as acceptable for flight.

k. Safety analysis/reports are complete, identified hazards are closed, Critical Items List (CIL) retention rationale accepted, and ALERTs are reviewed and are not a constraint to flight readiness.

l. Flight crew procedures are reviewed and concurred for flight.

m. All significant differences from previous flights are reviewed, and where required, are incorporated into applicable documents.

n. A project readiness review was satisfactorily completed.

o. Necessary safety analysis; materials tests; and, certification and flight readiness requirements are completed.

p. All equipment defined in Crew Compartment Configuration Drawings (CCCDs), plus Drawing Change Notices (DCNs), Mission Equipment Cargo Support Launch Site Installation Drawing, and/or the crew equipment list that one is responsible for, is processed for flight by approved procedures which includes the equipment by locker and installation location.

q. All equipment changes approved by the Flight Equipment Configuration Control Board are incorporated.

r. All changes or deviations to critical processes in equipment preparation are reported.

s. Payload and General Support Computers (PGSCs) are provided.

3.0 ACTIVITIES LEADING TO THE FLIGHT CREW EQUIPMENT FRR

The activity leading to the FRR of the Flight Crew Equipment Management Office constitutes an important part of our preparation for flight. These activities are:

a. Planning and operations meetings are held at the SFOC FCE processing facility in the Management Information Center. These meetings review hardware required for Crew Equipment Interface Test (CEIT); hardware deliveries to and from KSC; and, detail scheduling.

b. The Flight Crew Equipment Configuration Control Board (CCB) – The CCB reviews new and modified hardware proposals, open problems, and documentation changes.

c. Monthly Progress Reviews with:

   1. Avionic Systems Division
   2. Crew and Thermal Systems Division
   3. Flight Crew Support Division
   4. Medical Sciences/Propulsion and Power Division
   5. SFOC

NOTE: Space Shuttle SR&QA, and SFOC are required to attend each division meeting.

d. The Orbiter Photographic/Television Working Group (OPTWG) meeting review film processing, Earth observation photography, photography equipment provisioning, camcorder equipment provisioning, and training issues.

e. The Bench Review is held at the SFOC FCE processing facility. The Bench Reviews provide an opportunity for crew members to examine each item of crew equipment to be stowed in modular.

4.0 FLIGHT PREPARATION PROCESS

The flight preparation management process is intended to ensure that flight hardware and software will be designed, developed, and tested. The following divisions are involved in the process.

4.1 SAFETY, RELIABILITY, AND QUALITY ASSURANCE

4.1.1 Hardware Preparation Process

The following SR&QA Division process is followed for preparing hardware for flight:

a. SR&QA tracks all exceptions and actions until final resolution. In addition to the FRR process, constraints for flight readiness would be reported to the SR&QA Prelaunch Assessment Review (PAR) and FRR Tag–up held with other SR&QA organizations at NASA Headquarters, MSFC, KSC, and other centers/contractors, as appropriate.

b. The SR&QA organizations from the various centers have a closed–loop coordination system which includes the PAR process listed in the above response. While SR&QA may not be the originators of the final resolution, the action is tracked and reported on at various meetings such as the open problems and certification presentations at the weekly Flight Crew Equipment Management Office CCB, as well as, the PAR and FRR Tag–up meetings.

c. All waivers, deviations, exceptions, and restricted hardware dispositions are tracked in the certification process. Approval by all affected parties is required before flight approval (and release for flight shipment) is granted.

d. SR&QA has a closed–loop system for tracking all problems, including IFAs and unexplained anomalies. An example of this process is that SFOC is required to open a problem report on an IFA within 24 hours after it has been isolated to a LRU. The problem reporting system is maintained by the SR&QA organization who also must make a recommendation on the closure of IFAs and unexplained anomalies, and provides a signature approval for all problem reports.

e. Training is a high priority in the SR&QA community. All SR&QA engineers/quality specialists have individual training plans maintained in an automated data base. This training plan lists Priority 1, 2, and 3 courses. All Priority 1 courses must be completed before an engineer is able to perform any work without immediate supervision. SR&QA engineers/quality specialists who have completed Priority 1 training, but not all Priority 2, are closely monitored in all their activities until completion of this training process. Certification is limited to quality process–procedures and/or item handling. All certification is completed and noted in the engineer/quality specialist records with a high priority for completeness prior to use requiring it. Special training and certification are accomplished and maintained for verification of soldering and welding processes.

f. All GFE hardware requires a Project Management Plan (PMP) or equivalent (PRCBD, CCBD, Technical Task Agreement [TTA], Memorandum of Agreement [MOA], or memo), and Project Technical Requirements Specification (PTRS), or Specific Design Requirements Documents (SDRD), containing the data specified in NSTS 07700, Volume VI, Flight Support Equipment (FSE) Management, and JSC 61100. In case of requirement conflict, NSTS 07700, Volume VI shall supersede JSC 61100.

   If the requirements of new FSE hardware/software match the existing PRD requirements, existing PRDs or SDRDs may be referenced in the PMP or equivalent. For non–critical GFE, the Flight Crew Equipment Management Office maintains two existing generic PRDs, JSC 17038, SSP Flight Equipment Non–Critical Hardware Program Requirements Document, and NSTS 21096, Program Requirements Document, DTO/DSO Non–Critical Hardware. For Class D payloads, the JSC Medical Sciences Division maintains a generic PRD, JSC 25990, PRD for Payload Class 'D' Hardware. The PRD or PTRS and PMP for the hardware being developed/approved for flight will be reflected in the CR authorizing development/changes/stowage of the item for flight and also in the final flight certification documentation.

g. The Quality Assurance Organization verifies that the hardware conforms to the released engineering documentation and is the as–built configuration. The SR&QA flight certification documentation requires a part (dash) number of the test unit and flight unit. If there are any differences between the two (dash) numbers, satisfactory rationale must be provided. NSTS 07700–10–MVP–01, Shuttle Master Verification Plan, Volume I, General Approach and Guidelines, states that any changes that effect form, fit, function, safety, or reliability requires recertification (rolling a dash number).

h. SR&QA maintains a GFE certification data base where all hardware scheduled for a flight is identified. This data base has flight effectivity, certification status, limited life data, Failure Modes and Effects Analysis (FMEA) number and much more information. It is electronically compared against the Baseline Accounting Reporting System (BARS) and Mission–Unique Processing Plan (MUPP) reports to ensure the manual inputs did not overlook anything. Charts with the certification status are presented at the weekly Flight Crew Equipment Management Office CCB and at the Flight Crew Equipment FRRs.

i. Safety and Mission Assurance (S&MA) maintains a listing of all limited life time/ cycle GFE in the certification data base. Quality Assurance and the SFOC contractor track each Serial Number (S/N) item with limited life. The SFOC contractor has an automated tracking system that lists all limited life dates of each serial number item in their purview. S&MA checks with Quality Assurance and FEPC and reports on the limited life status at the FRR.

j. SR&QA maintains a closed–loop problem reporting system. All problems and discrepancies must be closed, or a satisfactory disposition made before the hardware can be shipped from JSC. Open problem issues require approval of the Chief, Institutional Safety and Quality Division prior to shipment.

k. Safety analysis/reports are now part of the certification process. Hardware cannot be shipped with an open certification paper without approval of the Chief, S&MA Division. Hazards, CILs, and Acute Launch Emergency Reliability Tips (ALERTs) status are reported to the management at the PAR, FRR Tag–up, Bi–weekly SR&QA Project Schedules Meeting, and the Project FRR.

l. SR&QA has a focal point for review of flight crew procedures. This focal point sends out notification of availability of these procedures on the Local Area Network (LAN) to the SR&QA community prior to each flight requesting comments. These data are all available on the LAN.

m. SR&QA reviews and prepares flight certification for hardware changed from previous flights. Contingency and planned EVAs are also reviewed/accessed for mission success and safety for each flight (see EVA Safety Summary).

n. SR&QA has PARs and FRR Tag–up meetings for each flight.

o. All required testing, analysis, and certification is completed and documented in the certification records for each flight.

p. SR&QA has no responsibility for hardware processing procedures at the flight equipment processing contractor facility other than a resident Quality Representative. However, for hardware checked out by OMRSD and for other JSC provided hardware, the verification process includes procedure approval. The CCCD is also electronically compared by the certification data base to verify that all hardware is approved for flight, except for turnaround checkout.

q. All Configuration Control Board Directives (CCBDs) are logged into the certification data base as soon as possible following approval. Required action is tracked and reported at the CCBs and other meetings as appropriate. Final certification approval is required prior to closure in the data base. These data are still maintained for historical purposes.

r. All changes or deviations to critical processes in equipment preparation are monitored by members of the SR&QA community as appropriate.

4.1.2 (Deleted)

4.2 PROPULSION AND POWER

4.2.1 Hardware Preparation Process

The following Propulsion and Power Division process is followed for preparing hardware for flight**:**

a. Flight hardware requirements are defined in the Program Requirements Document, specifications, OMRSD, Interface Control Document (ICD), drawings, and procedures.

b. The procedures for battery hardware fabrication are coordinated with Boeing, but the Propulsion and Power Division does not participate in the training of the technicians. Procedures and drawings for test, checkout, and assembly of the Orbiter Air Fuselage Gas Sampler System (OAFGSS) are provided to Boeing and KSC. Boeing and KSC procedures are also reviewed.

c. Information on battery hardware is initially provided to the crew trainers, but the Propulsion and Power Division does not participate in crew training. The Propulsion and Power Division does not participate in the training or certification of Boeing and KSC personnel who assemble and/or install the hardware.

d. Flight hardware certification is completed in accordance with an approved Certification Plan. The certification process involves successful completion of a qualification test program. Preparation/approval of Safety Analysis Reports (SARs), Hazard Analysis Worksheets (HAWs), and FMEA/CILs is coordinated with SR&QA and involves verification that safety analysis/reports have been completed, identified hazards are closed, and CIL retention rationale accepted. Completion of stress analysis and materials tests with the resultant materials certification are obtained. The design is certified upon approval/signature of the certification sheet for the hardware.

e. The hardware is verified as ready for flight via coordination between the responsible hardware engineer and SR&QA, Mission Evaluation Room (MER) personnel (if appropriate for the hardware), Boeing, and KSC. Verification involves ensuring that design modifications have been incorporated and the as–built flight configuration satisfies the released requirements; ensuring that flight hardware is within time, cycle, age life, interval inspection, and maintenance requirements; dispositioning/closing problems, unexplained anomalies, IFAs, waivers, and deviations; and identifying open issues as acceptable or scheduled to be resolved prior to flight. The certification of flight readiness for the hardware is presented to the Flight Crew Equipment Management Office FRR prior to the first flight of the hardware.

4.2.2 GFE Flight Readiness Products

The following is a list of the Propulsion and Power Division GFE flight readiness products:

a. Requirements Document for the hardware

b. Statement of Work and Specification for hardware, as required

c. Drawings

d. Certification Plan

e. Test Plans/Procedures/Reports

f. Certification Documentation (including Certification Report, Safety Analysis)

g. Report/Hazard

h. Analysis Worksheet, Failure Modes Effects and Analysis/Critical Items List

i. Materials and Stress Analysis, OMRSD and ICD updates, and Certification Sheet

j. Change Request to the Flight Crew Equipment Management Office Configuration Control Board

k. Hardware to Boeing for flight processing

l. CoFR signature for new hardware at first–flight FRR

m. Problem Resolution, if necessary, (i.e., engineering consultation; closure of Discrepancy Reports [DRs], Failure Investigation Analysis Reports [FIARs], etc.)

n. Presentation of flight readiness to Flight Crew Equipment (FCE) Flight Readiness Review

4.3 MANUFACTURING, MATERIALS, AND PROCESS TECHNOLOGY

4.3.1 Hardware Preparation Process

The following Manufacturing, Materials, and Technology process is followed for preparing hardware for flight:

a. **Materials Certification Process** – JSC materials certification is required to document that flight hardware has been evaluated for compliance with JSC GFE Materials and Processes (M&Ps) requirements. These requirements include flammability, toxic offgassing, thermal vacuum stability, corrosion, stress corrosion cracking, age life, fracture control, etc. Other M&P requirements include functional compatibility in various environments, as applicable. These include various fluids, temperature extremes, atomic oxygen, ultraviolet radiation, and other vehicle induced and natural space environments. Compliance with these requirements is evaluated by test and/or analysis. Tests include single material screening tests, or actual subassembly configuration tests.

   The materials certification process includes drawings and related documents review and approval, and issuance of a materials certification. A materials certification is issued by the Materials and Failure Analysis Branch (Code EM2) only after satisfactory completion of required materials testing, drawing review, fracture control analysis, and any required Material Usage Agreements (MUA).

   1. **M&P Drawing Review and Approval** – A Materials and Failure Analysis Branch approval signature is required on all GFE hardware drawings in the JSC drawing release system. The JSC Materials and Failure Analysis Branch signature on drawings provides only preliminary approval pending the resolution of any open issues, such as toxicity, vacuum, or flammability testing, MUA approval, fracture control analysis, etc. The JSC Materials and Failure Analysis Branch signature on drawings does not constitute materials certification or final materials approval of the hardware. This is only accomplished through a formal hardware materials certification.

   2. **Certification of New GFE Hardware** – For new GFE hardware, a materials certification issued by the JSC Materials and Failure Analysis Branch includes all top assembly part numbers and their dash numbers. Parts classified as subassemblies are not identified in the certification. The materials certification shall identify any MUAs applying to the hardware and the reason for each MUA (use of flammable materials, stress corrosion sensitive materials, etc.). The materials certification also indicates the vehicle locations (environments) approved, any flight number limitations, and any coded stowage conditions agreed to. Use of this hardware under different conditions may require a new materials certification.

   3. **Certification of Modified GFE Hardware** – JSC hardware that is modified by Drawing Change Notices (DCNs) that do not change the dash number is approved by a Materials and Failure Analysis Branch signature on the DCN. The materials certification is not revised. When drawing changes

result in the top assembly dash number being changed, a new materials certification is issued.

When drawing changes result in the part number being changed or the dash number being rolled but the changes have no effect on the rationale for MUAs applicable to the hardware, the revised part number may be redlined into the MUA, and the MUA is not formally revised.

For Criticality 3 Flight Crew Support Division hardware, Materials and Failure Analysis Branch signature approval of the Safety Analysis Report (SAR) amendment for modifications only to previously certified hardware is acceptable in place of a new materials certification.

b. **Materials Usage Agreement** – An MUA is required for the use of a material or process that does meet vehicle M&P requirements either by test, or by configuration analysis in the intended application, in the following areas:

1. Flammability
2. Toxic offgassing
3. Thermal vacuum stability
4. Fluid compatibility
5. Stress corrosion cracking
6. Corrosion

There are three categories of MUAs, as discussed below. MUA forms are used only for Category I and II MUAs.

- **Category I MUAs**: Category I MUAs are those that involve a materials/process usage that could affect the safety of the crew, vehicle, or mission; or affect the mission success, but must be used for functional reasons. These MUAs are approved by the hardware manager, the Materials and Failure Analysis Branch Chief, the Astronaut Office, and the Program Manager.

- **Category II MUAs**: Category II MUAs are those that involve a materials/process usage that fails a screening test and is not considered a hazard in its use configuration, but for which no Category III rationale code exists. These MUAs are approved by the hardware manager and the Materials and Failure Analysis Branch Chief.

- **Category III MUAs**: Category III MUAs (no MUA form is submitted) are used for hardware that either fails a materials screening test, or test data is not currently available. However, it is considered acceptable in the use configuration, and is defined in a rationale code. Rationale for acceptability in configuration is used instead of an MUA form. The acceptance rationale is first approved by the M&P drawing signature, and finally, by the materials certification. The acceptance rationale is recorded in the certification reference information forms maintained by the Materials and Failure Analysis Branch. (Whenever a Materials Identification and Usage List [MIUL] is specifically required by contract, a rationale code is reported in the MIUL.)

c. **Flammability Control and Flammability Stowage Policy**.

1. Flammability Control – Primary flammability control is based on using materials that are nonflammable or self–extinguishing within six inches when tested by NHB 8060.1C, Test 1. The configuration analysis or test shall comply with the guidelines of NSTS 22648, Flammability Configuration Analysis for Spacecraft Applications.

   Material flammability ratings and test data (as well as ratings and test data for toxicity, vacuum, etc.) are given in the updated Materials and Processes Tracking Information System (MAPTIS) data base, or in MSFC–HDBK–527, Material Selection List for Space Hardware Systems/JSC 09604, Material Selection List for Space Hardware Systems. The thickness specified for flammability includes the minimum thickness in which the material was tested. Thinner materials may not have the same rating, and may need to be tested to provide true worst–case conditions.

   If flammable materials must be used, they should be protected by covering with nonflammable materials, such as nonflammable tape, coatings, shrink tubing, etc.; if possible, without adversely affecting function, cost or schedule. If possible, the absence of ignition sources is not normally sufficient justification in itself for accepting flammable materials, but may be used as supporting rationale for acceptance. The Materials and Failure Analysis Branch flammability stowage policy may also provide for acceptance of flammable materials.

2. Flammability Stowage Policy – Small flammable materials that are normally stowed in a locker, or a nonflammable bag, or other container may be acceptable if the amount of time that they are left unstowed is sufficiently minimized. Various flammability stowage codes are used by the Materials and Failure Analysis Branch, depending on the size of the flammable material, and how long a time it will be left unstowed. If the size and stowage agreement meet the conditions for one of these codes, the stowage code is documented in the MUA section of the materials certification. If none of the

aforementioned flammability control measures, stowage codes, or Type III MUA rationale codes can be used, then a formal MUA is required.

d. **Off–the–Shelf (OTS) Hardware** – The Statement of Work and/or procurement request for OTS hardware requires identification of materials contained in off–the–shelf hardware wherever practical and cost effective. When detailed materials information for OTS hardware is not available, OTS hardware is evaluation by analysis and/or testing in configuration.

e. **Fracture Control** – Failures due to crack–like flaws shall be prevented on parts designated as fracture critical. Fracture control requirements for all structures, including pressure vessels, are provided in NHB 8071.1, Fracture Control Requirements for Payload Using the National Space Transportation System (NSTS) for both Orbiter and payloads, and in SSP 30558 for Space Station. JSC 25863, Fracture Control Plan for JSC Flight Hardware, may be used as the implementation document for fracture control, or fracture control plan, for both of the above requirements documents. Providing a fracture control summary report is one of the requirements indicated.

f. **Materials and Processes Intercenter Agreements** – NASA centers with reciprocal agreements for materials and processes with JSC, will generate MUAs and materials certifications on hardware that they manage or manufacture. These reciprocal or intercenter agreements involve acceptance of each other's materials certifications and MUAs. Currently, NASA centers that have reciprocal agreements with JSC include LeRC, MSFC, JPL, and GSFC. Copies of these agreements can be obtained from the JSC Materials and Failure Analysis Branch.

g. **Shuttle Orbiter and Shuttle Payload GFE for the International Space Station (ISS)**. JSC Shuttle Orbiter and Shuttle Payload GFE for ISS includes JSC GFE provided by the Space Shuttle Vehicle Engineering Office to support ISS, and Payload GFE provided by the Space Shuttle Systems Integration Office for ISS. JSC Shuttle Orbiter and Shuttle Payload GFE hardware are certified by the Materials and Failure Analysis Branch as meeting the requirements of SE–R–0006, General Specification Space Shuttle System Requirements for Materials and Processes, and/or NSTS 1700.7, Safety Policy and Requirements for Payloads Using the Space Transportation System. For previously approved hardware built to SE–R–0006 and/or NSTS 1700.7 and supplied to the ISS, MUAs and Flammability Stowage Codes referenced on the existing materials certification, shall be reviewed by the Materials and Failure Analysis Branch to verify compliance with ISS M&P requirements. If this hardware is modified for Space Station and the top assembly drawing dash number changes, a new materials certification shall be issued by the Materials and

Failure Analysis Branch. Otherwise, a formal materials recertification will not normally be required.

4.3.2 Manufacturing, Materials, and Process Technology Division Products Produced for Flight Crew Equipment Hardware

a. Materials certifications

b. MUA

c. White Sands Test Facility (WSTF) test requests

d. WSTF test results

e. Failure Analysis Reports

f. Contamination Analysis Reports

g. Fracture Control Summary Reports

h. Manufacturing process specifications

i. Fabrication of flight and prototype hardware

j. MAPTIS materials data base updates

k. OCCPs for ground testing of pressurized flight hardware

4.3.3 Documents Reviewed and Approved by Manufacturing, Materials, and Process Technology Division for Flight Crew Equipment Hardware

a. Certificate of Flight Readiness (CoFR) – FRRs and individual flight hardware

b. JSC flight hardware drawings (and DCN)

c. CCB Change Requests

d. Safety Analysis Report (SAR) Addendums

e. Flight hardware Discrepancy Reports (DR)

f. Safety and Mission Assurance Certification Approval Request (SMACAR)

g. Nonmetallic Materials Usage Logs for JSC chamber tests

h. Test Readiness Reviews

i. PRD or PTRS short forms

j. Fracture Control Plans

k. Materials Control Plans

4.3.4 Other Manufacturing, Materials, and Process Technology Division Support for Flight Crew Equipment Hardware

a. Overall JSC GFE materials control management

b. Materials selection and design support

c. Materials shelf life extension

d. Board membership on weekly Flight Crew Equipment Configuration Control Board

e. Presentation of flight materials certification status at FCE FRRs

f. Review FCE hardware requirements documentation

g. Support Preliminary Design Reviews (PDRs), Critical Design Reviews (CDRs), and other hardware reviews

h. Interpretation of WSTF test results

i. High pressure oxygen and propellant system analyses

j. Nondestructive testing and evaluation

k. Material chemical and physical property tests

l. Flight experiment development

m. Advanced materials and processes development

n. Pressurized hardware safety support

o. Fracture control implementation

4.4 EARTH SCIENCE AND SOLAR SYSTEM EXPLORATION

4.4.1 Hardware Preparation Process

The following Earth Science and Solar System Exploration process is followed for preparing hardware for flight:

a. STS flight dosimeters are provided as crew equipment to meet the operational, medical, and regulatory radiation measurement requirements for manned space flight, and are certified for flight readiness at the EVA Project FRR prior to each flight. Dosimeter assembly begins 30 days before flight, with delivery to SFOC 10 days before flight. Drawings, certification documentation, and detailed laboratory assembly/processing procedures are maintained by the JSC Radiation Dosimetry Laboratory. The current Shuttle radiation dosimetry complement materials/configuration was certified for 100 flights prior to STS–26 as part of the Return to Flight Design Requirements/Certification Review process. Shuttle dosimetry requirements are reviewed and implemented by the JSC MD 1152.9A, JSC Radiation Constraints Panel and have not changed since the STS–5 Mission. A highly reliable dosimetry system is maintained through stringent procedures for component acceptance testing/screening and calibration.

b. Passive dosimeters are reassembled with screened Thermoluminescent Dosimeter (TLD) chips and the pocket chambers are screened and reset to zero for each flight. Prior reviews/actions deal only with measurement quality. Failed or unreliable dosimeters are eliminated from flight category and flight readiness for next flight should not be impacted by any prior actions.

c. The only constraint to flight readiness for dosimetry is the assembly and delivery (to FEPC) schedule. Routine laboratory procedures satisfy this requirement.

d. Personnel operating the JSC Radiation Dosimetry Laboratory are required to be trained and experienced by job description and/or contract stipulation.

e. Radiation dosimetry flight hardware requirements are reviewed and implemented by the JSC Radiation Constraints Panel (RCP) as part of its charter. Requirements are documented in RCP minutes, hardware design certification/verification documentation, Shuttle medical/crew health requirements, etc.

f. Flight hardware is within time, cycle, age life, interval inspection, and maintenance requirements are satisfied by normal laboratory procedures.

g. Flight crew procedures have been released and verified for flight because the crew involvement is at ground request only. The crew has been briefed on pocket chamber readout and logging procedures.

h. Project/laboratory readiness reviews are periodically held by the Division, Branch, and Subsystem Manager. Project FRRs for each flight are part of the Space and Life Sciences Directorate FRR.

i. Radiation dosimeter hardware are packed and shipped by SFOC.

4.5 FLIGHT DATA FILE

4.5.1 Hardware Preparation Process

The following Flight Data File (FDF) process is followed for preparing hardware for flight:

a. The Procedures Management Office ensures that any exceptions which constrain flight readiness are resolved before the next flight.

b. Constraints to flight readiness are identified or scheduled for completion or resolution by the Crew Procedures Control Board (CPCB). Status is presented at the MOD or FCE FRR.

c. Waivers, deviations, exceptions, and restricted hardware dispositions are reviewed by the Procedures Management Office with the appropriate CCB or OPR to ensure resolution for flight readiness.

d. Problems, unexplained anomalies, and IFAs are evaluated and documented by the Procedures Management Office and the issues resolved with the appropriate forum. Results are presented at the MOD or FCE FRR.

e. FDF book managers, coordinators, and fabricators are trained and certified.

f. Flight hardware requirements are defined in the Crew Procedures Management Plan (CPMP), Appendix G, and the FDF manifest for each flight.

g. Items are checked against fabrication handbook requirements, which are derived from CPMP, Appendix G, specifications and end item drawings.

h. Flight hardware certification of new items is coordinated by the Procedures Management Office.

i. Limited life items are checked against product lifetime specifications and results are logged in the FDF configuration binder.

j. The Procedures Management Office reviewed all flight hardware discrepancies and problems, and coordinates any remedial actions required to ensure flight readiness.

k. Safety analysis reports, etc., have been completed for all standard FDF items. The Procedures Management Office will coordinate review of these issues for new items and ensure that all necessary actions are taken to ensure flight readiness.

l. Procedures are released and verified for flight via the Procedures Validation Review, a formal audit chaired by the MOD.

m. Procedures Management Office reviews all significant differences from previous flights and ensures these differences are recorded in the appropriate documentation.

n. Project Readiness Reviews are completed for each flight. Results are presented to MOD and FCE FRRs.

o. The Procedures Management Office ensures that necessary safety analyses, materials tests, and certification and flight readiness requirements are completed for each flight.

p. FDF will be stowed at KSC as defined by the CCCD and the flight specific FDF manifest.

q. The Procedures Management Office ensures that all equipment changes approved by the flight equipment CCB are incorporated into the FDF before each flight.

r. The Procedures Management Office ensures that all changes or deviations to critical processes in equipment preparation are reported to the appropriate forum in a timely manner.

4.6 AVIONIC SYSTEMS

4.6.1 ASD Hardware Preparation Process

The following Avionic Systems Division (ASD) process is followed for preparing hardware for flight:

a. **Product No. 1** – Mission Specific Camcorder System Assembly Kit Stowage Document EE2–91–011/XX.

   Process:

   1. Prior to each flight, a complete set of video equipment requirements for that flight are provided to the ASD by the Photo/TV Working Group.
   2. The required equipment is appropriately documented for stowage by the generation and publication of Product No. 1.

b. **Product No. 2** – CoFR for new or modified items of FCE flight hardware.

   Process:

   1. Configuration control drawings of hardware are complete and released.
   2. Hardware configuration is verified.
   3. All certification testing and analysis is complete.
   4. All safety analyses are complete and approvals are obtained.
   5. All necessary materials testing and analysis is complete.
   6. Approvals for any required program waivers are obtained.
   7. Any and all open problems are resolved and closed.
   8. Authorized CoFR signatures are obtained.

9. The signed–off CoFR is presented at the FRR.

c. **Product No. 3** – Delivery of flight hardware for which ASD has flight processing responsibility.

   1. Required hardware is inspected and subjected to a performance acceptance test.

   2. Any and all discrepancies resulting from inspection and test are resolved and closed.

   3. Any and all open problems from previous flights are resolved and closed.

   4. Hardware is delivered to SFOC for bench review and flight stowage.

4.6.2 ASD Flight Readiness Products

The following is a list of the ASD Flight Readiness Products:

a. Mission Specific Camcorder System Assembly Kit Stowage Document, EE2–91–011/XX (generated for each flight)

b. CoFRs for new or modified items of FCE flight hardware (generated as required)

c. Delivery of actual flight hardware for which EV/ASD has flight processing responsibility (as manifested)

4.7 CREW AND THERMAL SYSTEMS

4.7.1 (Deleted)

4.7.1.1 (Deleted)

4.7.2 CEE Hardware Preparation Process

The following CTSD process is followed for preparing Crew Escape Equipment (CEE) hardware for flight:

a. **Generic Mission Events** – This process defines the manpower and events required to support the crew training and program requirements preceding a launch flow. CTSD (EC) is responsible for defining the equipment needs, coordinating the manpower support, and supervising the event where CEE and crew ingress are concerned. This support is comprised of SFOC, which processes the CEE; Aircraft Operations Division, which processes the personal parachute assembly; and Lockheed Engineering, which provides technician and engineering support. All configuration management is the responsibility of EC. EC is also responsible for all design changes; drawing updates; documentation; failure analysis and investigation; flight readiness; and mission engineering support.

b. **Terminal Countdown Demonstration Test (TCDT)/Launch Flow** – This process defines the events required to support a TCDT and launch flow at KSC. The equipment inspection/test, crew fitchecks, crew insertion and post–event activities are detailed in this flow. EC, Lockheed, and Boeing/FEPC all have a role in the successful completion of this flow.

c. **Landing/Recovery** – This process defines the events required to support the landing/recovery for a Shuttle mission at both the prime and backup landing sites. EC has the lead at the prime site, Lockheed has the lead at the backup site, and Boeing supports both sites with CEE technicians.

4.8 (DELETED)

4.8.1 (Deleted)

4.9 FLIGHT CREW SUPPORT

4.9.1 Flight Crew Equipment Hardware Preparation Process

The following Flight Crew Support Division process is followed for preparing Flight Crew Equipment hardware for flight:

The division's Shuttle crew compartment provisions reflect the Program Requirements Documents (PRDs), Project Technical Requirements Specifications (PTRSs), Project Management Plans (PMPs), and Configuration Control Board Directives. Hardware, based on these requirements, is processed by initiating a PMP and PTRS per the JSC 61100, Project Management Guide or, if appropriate, utilizing an existing Program Requirements Document (PRD) for Criticality 1 or 2; utilizing PRD JSC 17038, SSP Flight Equipment Non–Critical Hardware Program Requirement Document, for Criticality 3; or identifying noncritical PRD NSTS 21096, Program Requirements Document, DTO/DSO Non–Critical Hardware, for DSO/DTOs. A PMP is written to establish definition and schedules for Preliminary and Critical Design Reviews, testing, certification/validation, acceptance, and delivery. The PMP is approved before the PTRS or SDRD is approved.

Particular phases of readiness are:

a. **Preliminary Design** – The preliminary design and analysis are based on the specifications and requirements called out in the PRD or PTRS. The results of the preliminary design and analysis are used to develop the detailed design. When the preliminary design is well formulated and no significant changes are foreseen, the design documentation is assembled and the PDR is held.

The preliminary design is accomplished through the performance of four sub–tasks:

1. Perform design analysis
2. Fabricate engineering unit
3. Produce engineering drawings
4. Conduct preliminary hardware and software testing

The analysis includes various design disciplines (i.e., electrical and electronic; thermal; propulsion; structural; mechanical; software; communications and control; configuration management; and, packaging). The successful interplay of each of these disciplines to ensure mission success is verified. The specific design and verification requirements are identified and form the basis for the analyses.

b. **Fabricate Engineering Units** – To ensure the design, fit, and performance and to assure project feasibility, an engineering unit, which should closely approximate the planned final design, is fabricated. The engineering unit can serve as a prototype unit. Prototypes are tested to evaluate proposed system and subsystem designs. They are typically subjected to structural loads and temperature testing over the specified operating temperature range to verify performance. The results of prototype testing either demonstrates design credibility ensuring fewer problems in qualification test unit development and testing or identifies design flaws which require design changes.

c. **Develop Preliminary Drawings** – This task consists of the preparation of a set of drawings which will eventually be developed into the certified flight item drawings. The preliminary drawings present the design as developed and verified from the design analysis effort and take into consideration the project conceptual layouts and drawings. The preliminary drawings must reflect a design that accomplishes the following:

1. Ensures each part’s fit and function
2. Ensures adequate tolerances to provide desired operation and performance
3. Minimizes rework

4. Is detailed sufficiently to allow fabrication of an engineering and thermal unit which can be used in design verification testing

The approach for preparation of drawings, identification of required approval signatures, and subsequent configuration control of drawings is presented in JSCM 8500, Engineering Drawing System Manual (B–35).

d. **Perform Preliminary Hardware and Software Testing** – Breadboard fabrication, assembly, and testing are typically done in the preliminary and early design phases of flight hardware development. Breadboards are used to evaluate proposed circuit designs and subsystem designs. They are typically subjected to temperature testing over the specified operating temperature range to verify performance. The results of breadboard checkout and testing are fed into the design process. This evolutionary approach lends confidence and credibility to the design.

e. **Technical Readiness Review** – During the Technical Readiness Review, the total design is reviewed for feasibility and capability to meet all objectives of cost, schedule, and function. The review is conducted by the project manager and all work breakdown structure leaders and assures that the program is ready for Preliminary Design Review (PDR). During the Technical Readiness Review, all analyses and test results are reviewed to verify that the design will be able to satisfy the functional requirements.

f. **Preliminary Design Review** – The purpose of the PDR is to obtain concurrences on and approval of the design concept and to obtain authorization to perform the final, detailed design. It is intended to ensure that the proposed design satisfies established requirements, within existing technologies, that adequate manufacturing, test equipment, and facilities are available; and, the project is achievable within cost, resources, and schedule.

The PDR is a recognized milestone in the configuration management process and is held early in the design phase, with how early varying from one organization to another. Most organizations use “when approximately 10 percent of the drawings are completed,” but at least one organization quotes a “25 percent of drawings complete” as a criterion. The objective is to have the review early enough for resulting design changes to be made without major cost and schedule impacts. Typically, SS&MA begins reviewing data to be made available at the PDR two to four weeks before the formal PDR date. Based on inputs from the experiment or payload organization, the responsible project office schedules the PDR, notifies all of the required attendees, and makes appropriate distribution of data to be previewed.

1. The PDR must include an evaluation of the design concept compliance with the Systems Requirements Document and PDR, with decisions based on the following items:

   (a) Specific design criteria and other applicable requirements

   (b) Compatibility with interface and operational requirements

   (c) Feasibility of the proposed schedule

   (d) Consideration of induced and natural environmental criteria

   (e) Conformance to requirements for transporting, storing, and handling of GSE

   (f) Inclusion of reliability, maintainability, quality, safety, and human factors requirements

   (g) Manufacturing requirements and ease of manufacturing

   (h) Generation, approval, revision, retention, and retrieval of adequate documentation and data

   (i) Adequacy of concept to satisfy thermal, electrical, mechanical, structural, and performance requirements

   (j) Ease of inspection and testing

2. At least 14 days before the PDR, preliminary versions of the following documents, as specified in the PRD, PTRS, or PMP, should be made available to the JSC and contractor/subcontractor personnel identified in the PRD or PMP as participants in the PDR:

   (a) Preliminary ICDs

   (b) Design analyses

   (c) Layout, general arrangement, and envelope drawings

   (d) Schematics and block diagrams

   (e) Sizing

   (f) Material and process specification listings

   (g) Applicable procurement specifications

   (h) Test requirements

(i) Mockup and models

(j) Updated plans, procedures, and schedules

(k) Identification, rationale, and status of commonality candidates

(l) Proposed additions to the NASA baseline

(m) Selected SS&MA documentation (FMEA/CIL), hazard analyses, etc.

(n) PRD, or PTRS and PMP

(o) Systems Requirements Document

(p) Nonmetallic Materials List

(q) Payload Integration Plan (in draft form) and Payload Integration Plan Annexes

(r) Electrical, Electronic, and Electromechanical (EEE) parts lists

(s) EEE parts stress analysis

(t) EEE irregular parts application requirements

A design review team consisting of the customer, the project manager, lead division technical and management representatives, all supporting organization key technical and management personnel, potential users and participants, and experienced representatives from other similar projects review all data presented to determine if the design is mature enough to proceed to the final design. The Review Item Disposition (RID) form (JSC Form 1491) is used by the design review team to document recommended changes to the design, requirements, or documentation for the flight hardware.

There are two requirements for impaneling:

1. In addition to the customer, all supporting organizations (including SS&MA, Fabrication, Flight Operations, Astronaut Office, and others that will participate in the design, fabrication, certification, and use of the flight item) should be represented on the review board or panel.

2. If the appropriate project office and performing organization management do not participate directly in the review, the board Chair and authority should be previously authorized by and report to these organizations.

The products of the PDR and post–PDR activity are the approval of design plans, specifications and documentation, including amendments (approved

RIDs) authorized by the RID Review Board, and authorization to proceed with the detailed design effort. Upon completion of a successful PDR and receipt of approval to proceed, some documentation such as unique ICDs may be placed under formal configuration control and additional changes to them require CCB approval. Other items that define the configuration will not yet require formal configuration control; but, since the design has been formally reviewed, a project level configuration control panel should be established to control the approved configuration, contents of all documents, and hardware descriptions. Changes should be tracked and discussed at the CDR.

g. **Perform Post–PDR Activity (RID Closure and Documentation)** – Post–PDR activities include any actions or remaining issues that may have been initiated but not closed during the PDR.

   1. All RIDs must have been either tabled or accepted as an action.

   2. All RID issues must have been resolved and any actions closed out with approval from the customer or project manager and the RID Review Team.

   3. Modifications to requirements, specifications, and design resulting from RIDs must have been incorporated into the flight item concept.

   4. If deemed necessary, a Delta PDR will be held to verify that all concerns and issues addressed by RIDs have been properly dispositioned.

h. **Perform Detailed Design: Prepare Acceptance and Certification Plans, Drawings, and Procedures** – This task involves the performance and integration of the individual–discipline design efforts as established by PRD or PMP requirements and approved changes resulting from the PDR. It brings the flight item design to a state of readiness which will allow for the fabrication of hardware with proper fit and function. The design documentation at this stage must be capable of demonstrating that the project's functional and performance objectives and goals are achievable.

   Design for drawings must be complete and call out all specifications which will allow for the fabrication of all components and ensure fit and function. Included in this effort is the selection of the following: Proper materials, EEE parts, and mechanical parts. Parts lists are generated at this point.

   Procedures must be developed to ensure successful handling, testing, integration, and care of all hardware and software.

   The project manager is responsible for ensuring that this process is conducted and participated in by all supporting organizations. A review of manufacturing processes and procedures must be conducted with all responsible persons in order to establish a reasonable overall manufacturing schedule, test plans, and review procedures. All long lead items and processes must be identified and the schedule adjusted to accommodate these items and processes.

This task is accomplished through the performance of several sub–tasks. Some processes may require the iterative use of the sub–tasks in the process. The sub–tasks are as follows:

1. Layout, code, and test software
2. Design and fabricate GSE and test hardware
3. Perform detailed analysis
4. Fabricate and upgrade (or modify) prototype unit
5. Produce training hardware and mockups
6. Produce engineering drawings
7. Conduct development, functional, and operational tests

i. **Perform Detailed Analyses** – At this stage of flight item development, the project objectives and goals are well defined and assured by the definition of the project's functional, design, and performance requirements. The detailed analysis consists of verifying that each subsystem, and in turn the whole system as designed, will survive and perform up to specifications and requirements under the expected environment. The interplay and dependence of each subsystem design must be verified through analysis. The analysis must verify, among other things, that the design will sustain all mission loads, fall within minimum and maximum weight design constraints, provide proper thermal environment to ensure survival and functioning of all components, electrical compatibility, and performance. Other analyses required may include FMEA and hazard analysis.

The results of these analyses should also provide test parameters to which the subsystems (and total system) under various technical–discipline testing should be tested in order to ensure compliance of the design to the requirements.

In general, engineering is responsible for the performance of all these analyses under conditions defined in the Memorandum of Understanding. The responsibility belongs to SS&MA to ensure that all applicable analyses are performed and to take into account all appropriate considerations.

The results of all analyses must be documented to allow for any needed design adjustments and for preparation of test plans. The written results and reports from analyses shall become part of the CDR package documentation.

j. **Layout, Code, and Test Software** – The purpose of the layout task is to design the software structure to satisfy all requirements allocated to the software system.

   For the SSP, the Shuttle Avionics Software Control Board (SASCB) will require documentation verifying that the flight item software is compatible with and posses no threat to the Space Shuttle Software System.

k. **Fabricate and Upgrade Prototype Unit** – A test unit is fabricated to demonstrate that the flight item design is feasible and will perform or function as designated.

   The designer should identify key inspection points with SS&MA and maintain control documentation, as required, to verify the hardware configuration as a base for testing and for design changes. There are no SS&MA controls on development hardware unless the development tests are to be used to satisfy certification requirements.

l. **Design and Fabricate GSE and Test Hardware** – The flight hardware designer should work with the subsystem analysis results in the design of test support hardware required to accomplish testing of flight articles. The test support hardware must be designed and built to be able to support or allow environmental (electrical, thermal, etc.) simulation under which the performance requirements will be verified.

   Refer to JSC Specification SW–E–0002, Space Shuttle Ground Support Equipment General Design Requirements, as the design requirements guide.

m. **Critical Design Review** – The CDR is a technical review involving the project manager, the customer, and technical personnel from all supporting and performing organizations. The purpose of the CDR is to make the decision of whether the design is mature. Evidence must be presented at the CDR that the design satisfies the established project requirements and specifications to the point that authorization can be given to proceed towards completion of design, design verification, release to manufacturing of all engineering drawings, and actual building of flight hardware and software. The design should be sufficiently mature at CDR to support the approval of all planned qualification and certification testing. The CDR also ensures that the detailed design and implementing procedures are compatible with required manufacturing procedures.

   The CDR is held prior to the release of the design to manufacturing, usually when the detailed design is near completion (from 90% to 100% complete depending on controlling organization). The objective is to detect discrepancies between the design and the requirements prior to fabrication of verification hardware, and to certify that the verification plan and procedures are adequate.

1. As a minimum, the CDR must include an evaluation of the detailed design with decisions based on information furnished at the PDR, plus the following considerations:

    (a) Detailed design

    (b) Detailed environmental, thermal, electrical, structural, and mechanical analyses

    (c) Final interface definition

    (d) Development test data

    (e) Trade–off studies

    (f) Requirements which have been added or change since the PDR

    (g) Parts and materials selection

    (h) Manufacturing and test plans and procedures (i.e., ease of manufacturing, inspection, and testing)

    (i) Completion of action items generated at the PDR

    (j) SS&MA considerations

    (k) Crew interfaces

2. In addition to the type of material presented at the PDR, the minimum required information which must be complete and ready for presentation at the CDR is the following:

    (a) Nearly complete set (90% or more complete) of detailed design drawings

    (b) Definition of all interface requirements and ICDs

    (c) Complete and detailed analysis and reports

    (d) All test data and results, analyses, and reports

    (e) Manufacturing and procurement specifications

    (f) Mockups (fit and training), models, prototype hardware (or software), and breadboards. (NOTE: This requirement may involve a separate time for the CDR team to get to a shop or test area to review these items.)

(g) Program procedures and schedules

(h) Appropriate SS&MA documentation (FMEA/CIL, hazard analyses, etc.)

Upon completion of the CDR and satisfactory disposition of all RIDs and acceptance of design readiness by the design review board, the authorization to complete the final design and to fabricate the hardware (which includes final software development and verification) shall be given. Also, upon completion of the CDR, all design drawings are placed upon strict configuration control by a CCB.

n. **Baseline Design and Release Drawings** – Official release of drawings should take place (and be 100% completed) after the CDR. At this point, SS&MA can certify that the design has satisfactorily met all programmatic and performance requirements. However, prints of the drawings are required before qualification test articles can be fabricated and the qualification process performed.

   Once the verification process is completed, all drawings must again be certified by each technical discipline having approval authority (i.e., structures, materials, SS&MA, etc.) as meeting design requirements. For official release, final approval signatures for release are obtained and the drawings are submitted to the Drawing Control Center with the required forms. The drawings are then released under strict configuration control for use in the fabrication of flight hardware and software. JSCM 8500, or any other NASA–approved drawing system, will give drawing procedures and identify the necessary approvals needed to release drawings.

o. **Manufacture Flight and Certification Hardware** – Flight item hardware will be built to specification and configuration requirements. Documentation to verify compliance with design and fabrication procedures will be filled out and maintained. During the manufacturing period, QA will have the responsibility of ensuring compliance of all hardware and software testing to CDR–approved documentation.

   Configuration and design changes are documented as DCNs or note by incrementing the drawing “dash” number. Design changes are maintained by the design, manufacturing, and SS&MA organizations. Both notification methods require approval by authorities in the technical disciplines. All changes that affect form, fit, or function must be approved in writing by the CCB before implementation.

p. **Perform Acceptance Test and Place Hardware Under Bonded Storage Control** – Upon completion of the manufacturing and assembly process but before acceptance by NASA, the hardware will undergo a PDA test to verify that the hardware meets the requirements specified in the Systems Requirements Document. It will also undergo environmental testing to verify that the hardware is free of any workmanship defects. It is at this point that the hardware, including any ground support equipment, is placed in bonded storage and controlled under the requirements that detail the hardware movement, classification, control, test inspection, and identification. These requirements are specified in JSCM 5312Q, Quality Assurance Manual, in the following sections:

1. QOP 2.3, Acceptance Review Requirements and Procedure
2. QOP 3.1, Identification, Classification and Control of Equipment
3. QOP 11.7, Control of Hardware Movement

Acceptance testing does not satisfy certification requirements.

NOTE: The requirements for control of flight hardware are not applicable to training hardware.

q. **Test Readiness Reviews** – Test Readiness Reviews should be held before each major test (e.g., vibration, electromagnetic interference and electromagnetic compatibility, and thermal vacuum) to verify that the test specimen, procedures, equipment, and facilities are ready to perform the test. Engineering personnel are responsible for conducting the Test Readiness Review.

Required data include the following:

1. Approved test procedures
2. Status of open work
3. Test schedule and a list of responsible test personnel
4. Test specimen and facilities readiness (e.g., calibration, etc.)

r. **Perform Certification Tests and Analysis: Thermal and Vacuum; Thermal; Vibration; Electromagnetic Interference; Fit Checks** – The purpose of this activity is to perform the testing required leading to certifying the hardware for flight.

Upon completion of each acceptance and certification test, the test data are analyzed to determine if the flight item is acceptable, conforms to specification, and is ready to proceed toward flight. If not, a DR, per the requirements specified in JSCM 5312Q, Quality Assurance Manual, is prepared which could result in a decision to modify the design, to change an operation or procedure, or to grant a waiver. If the design is modified, a new series of certification tests and analyses will be conducted. Prior to a waiver being granted, the customer, SS&MA, and management must determine that the discrepancy noted during testing will not result in a potential loss of life, mission, or key objective.

s. **Certification Process** – Responsibility – The methods for certification of a flight item, as delineated in the certification requirements index in the certification plan, are:

1. Testing
2. Similarity
3. Analysis
4. Method to be determined
5. Previous certification

It is the responsibility of the subsystem engineer to determine and propose the method of certification. Certification by testing encompasses acceptance testing and qualification testing of the qualification test unit and the flight unit. The certification plan, which is formally approved, specifies the kind of tests and the methods of conducting them.

t. **Qualification Testing** – Qualification testing is conducted according to the qualification test plan and the qualification test procedures, which are formally documented. Test data sheets or TPSs (JSC Form 1225) are used to record test results. Each step of the qualification procedures is listed on the test data sheet or on the TPS in the sequence it is to be accomplished. MIPs are specified by SS&MA and signed off by QA after they have been completed. The procedures list the qualification tests specified in the certification requirements index in the certification plan.

The test levels and test durations are also specified in the qualification test plan and are called out in the qualification test procedures. JSC SS&MA approves the test levels and test durations based on factors such as the mounting location in the Orbiter and on the number of missions for which the qualification unit is to be qualified. The sequence in which these tests are conducted can be the same general sequence as will be encountered in flight. However, factors such as schedule, availability of test facilities, and special design constraints may influence the test sequence.

The qualification test unit is subjected to the following sequence of tests to verify that the hardware will perform its intended function for the maximum number of missions on which it is to be flown:

Acceptance tests described in the acceptance test plan and acceptance test procedures:

1. A functional test at ambient temperature
2. An environmental acceptance test, during which the unit is functionally tested over a prescribed temperature range and subjected to other specified environmental tests
3. Qualification testing as described in the qualification test plan and the qualification test procedures
4. Repetition of the acceptance tests described in item a

After successful completion of each series of tests, the qualification test unit is returned to the JSC flight crew equipment bonded storage. Under some circumstances (i.e., if it can be shown that no degradation occurred during qualification testing), the qualification test unit may be refurbished for trainer operations

u. **Certification Summary** – Certification is the final acceptance of the end item for its intended use. Certification documentation includes:

1. Documentation for factor tests at the contractor's plant (either on–site at JSC or off–site) to satisfy DD 250 approval
2. Documentation for tests conducted to verify rework and modification activity
3. Documentation for performance screening of the flight unit just before certification
4. Documentation for field acceptance, including screening at JSC prior to equipment use or testing, as well as screening tests before delivery for further integration, tests, or flight
5. The final certification report

In time–critical situations, qualification test site acceptance may be conducted by the subsystem manager and the reliability representative.

v. **Design Certification Review** – At the completion of the design certification process, a Design Certification Report is prepared that includes or references all documents generated during the certification. These documents include analysis reports, test plans, test procedures, test reports, RIDs, problem reports and resolutions, and all other items affecting the certification of the flight item. The Design Certification Report is formally presented for review by SS&MA to ensure that all requirements have been met.

w. **Deliver Equipment: Prepare Certificate of Flight Readiness Report** – The certification ensures that the flight hardware and software are properly configured and have satisfactorily completed the required phases of design, development, manufacture, modification, assembly, test, certification, verification, installation, and checkout in accordance with the established requirements.

NOTE: The following section refers to Appendix A, Attachment I, Paragraph 1.0.

x. **Conduct Flight Readiness Review** – FRRs are conducted to establish that the total flight item, GSE and all supporting organization elements necessary for safe and successful conduct of the launch, flight, and post–flight operation and are ready to support and justify the “Go for Flight” decision. FRRs for flight hardware should take place prior to shipment of the flight article for integration with the launch vehicle. The review addresses activities such as certification, hazards, the Critical Items List, flight operation issues, and other problems.

y. **The following guidelines apply to the FRR**:

1. All issues are addressed and resolved as directed, and/or appropriate waivers/MUAs are initiated and approved.
2. IFAs, DRs, and certification are addressed and closed by the responsible subsystem engineer prior to flight.
3. Safety reports are initiated and submitted to the appropriate board as required, and approved.
4. Issues are documented and problems resolved.
5. Pre–trained assigned personnel are instructed by preflight meetings each mission for MER support. Support activity respect to crew waking hours.
6. Subsystem engineer has signature approval authority for drawings and DCNs.
7. Drawings are released, SARs/HRs, waivers, certs are approved.
8. All hardware has processing documents that define the above listed criteria.
9. Subsystem engineer signature of approval is on DRs.
10. FMEA/CILs, SARs/Hazard Reports (HRs), and ALERTs are reviewed and dispositioned as required.
11. Flight crew procedures are provided for operational procedures on selected hardware.

12. Crew debriefing comments are addressed at Flight Crew Equipment Management Office CCB for action addresses and subsequent closure.

13. Subsystem engineer conducts functional test and verifies all requirements are met and documentation closed.

14. All SARs, materials certification, reliability certification, waivers, MUAs, etc., are signed and closed our prior to FRR.

15. The CCCD and the BARS–04 Report verifies that all hardware has been processed for flight and has a designated stowage within the crew compartment on the Shuttle.

16. Flight Crew Support Division utilizes CCBD numbers and corresponding mission effectivities to assure manifest.

17. All drawings and procedural changes must have prior subsystem engineer signature approval.

    (a) The FRRs for all flight hardware and software are conducted by the Project Office.

    (b) The Engineering Directorate or the Space Shuttle Engineering Office organization is responsible for the preparation of the FRR presentation.

Supporting organizations must provide all supporting information resulting from their roles in the preparation and development of the flight item.

4.9.2 Flight Crew Support Products

The following is a list of the Flight Crew Support Division's flight readiness products:

a. Configuration Documents

    1. Crew Compartment Configuration Drawing (CCCD)

    2. Orbiter Crew Compartment Interface Control Annex

    3. Food Installation Shuttle Food System

    4. Photographic Equipment Stowage

    5. Flight Photographic Equipment List

    6. Crew Compartment (Electrical) Plug in Plan

b. Government Furnished Equipment (GFE)

1. Food provisions and galley
2. Clothing, soft goods, and linens
3. Personal hygiene
4. Personal and off–duty equipment
5. Photographic and optical equipment
6. Housekeeping equipment
7. Stowage provisions
8. Decals and placards
9. Elect measurement/distribution provisions
10. Contingency hoses and adapters
11. Lighting equipment
12. Crew compartment tools
13. Restraints, recumbent seating system, electronic still camera, trash compactor, educational equipment, food warmer

c. Contractor Furnished Equipment (CFE)

1. Crew and passenger seats
2. Sleep accommodations
3. Ground emergency egress equipment
4. Trash management provisions
5. Stowage lockers/compartments

4.10 MEDICAL SCIENCES

4.10.1 Non–Critical DSO/DTO Hardware Preparation Process

The following Medical Sciences Division process is followed for preparing non–critical medical DSO/DTO hardware for flight:

a. Reflown DSO/DTO (no modifications):

1. Review certification with Reliability to verify that hardware is within certified number of flights. Approval from NASA Subsystem Manager and Reliability.

2. Perform functional testing of hardware as pre–installation acceptance test to verify proper functionality.

3. NASA quality verification with NASA record center that no open items (test preparation sheets, discrepancy reports, drawings, etc.) exist on the hardware part number and serial number.

4. Stowage/Structural Interface Verification – This includes (as required):

   (a) CEIT support

   (b) TCDT support

   (c) Bench review support

   (d) Weight and Center–of–Gravity (CG) testing

5. Prepare DTO/DSO/RME Reflight Information Matrix for Payload Safety and receive safety approval that no further analysis is required.

6. Present CoFR at FCE FRR.

b. New DSO/DTOs and Reflown DSO/DTOs (with modifications)

Primary Products:

1. Safety Compliance and Reliability Certification Data Packages – (This includes all test and analysis mentioned above). NASA Subsystem Manager and SS&MA approval required on both products.

2. Present CoFR at FCE FRR.

c. New DSO/DTOs and Reflown DSO/DTOs (with modifications)

1. Prepare Acceptance/Certification Requirements Matrix. Perform Space Shuttle Criticality Analysis (informal FMEA) with Reliability to determine criticality. Approval from NASA Subsystem Manager and Reliability on both items.

2. For reflown hardware, design changes are implemented (as required) to correct any in–flight anomalies experienced.

3. Perform all required certification and acceptance testing on NASA Test Preparation Sheets (TPSs) with approval signature from NASA Subsystem Manager, NASA Quality and NASA Reliability. This testing/analysis includes (as required):

   (a) Functional tests

(b) Science verification

(c) Battery certification by EP5

(d) Heat rejection

(e) 96–Hour burn–in

(f) Touch temperature

(g) Materials certification memo

(h) Compliance to JSCM 8080, JSC Design and Procedural Standards Manual

(i) Acoustic testing

(j) Electromagnetic Interference (EMI)

(k) Launch level and acceptance vibration testing

(l) Structural analysis approved by ES

(m) Offgas testing

(n) Acceptance thermal cycle

(o) Material usage agreements

(p) Applicable standards

4. Engineering Drawing Preparation and Approval by NASA Materials, Quality, Stress, Structures, NASA Subsystem Manager in accordance with JSCM 8500.

5. Stowage/Structural Interface Verification – This includes (as requires):

   (a) CEIT Support

   (b) TCDT Support

   (c) Bench Review Support

   (d) Weight and C.G. Testing

6. Evaluate potential hazards in preparation of Standardized Hazard Control Report and complete Certification of NSTS Payload Safety Compliance sheet. The following items are evaluated, and safety verification testing is performed (as required):

(a) Structural failure

(b) Sharp edges

(c) Flammability

(d) EMI results

(e) Touch temperature

(f) Toxicity

(g) Shatterable material release

(h) Materials offgassing results

(i) Battery failure

(j) Bioinstrumentation/leakage current

7. NASA quality verification with NASA Record Center that no open items (test preparation sheets, discrepancy reports, drawings, etc.) exist on the hardware part number and serial number.

4.11 MEDICAL OPERATIONS

4.11.1 Hardware Preparation Process

The following Medical Sciences Division (Medical Operations Branch) uses the following process for flight crew equipment:

The Medical Operations Branch (MOB) is responsible for processing and delivering to SFOC the following components of the SOMS for flight:

a. Emergency medical kit

b. Medical accessory kit

c. Airway medical accessory kit

d. Patient restraints

e. Resuscitator

f. Medications and bandages kit

g. Medical extended duration Orbiter pack

h. Contamination cleanup kit

i. Rescuer restraints

All components fly for each Space Shuttle mission with the exception of the Medical Extended Duration Orbiter Pack, which is used for Extended Duration Orbiter missions only. The MOB is also responsible for processing and delivering to FEPC the crew eye wear for incorporation into the crew compartment stowage.

The detailed procedural, quality, safety, and reliability requirements for preflight, in–flight, and post–flight processing of the SOMS hardware and crew eye wear are defined in JSC 24734, Medical Operations Shuttle Orbiter Medical System Processing Document.

4.12 (DELETED)

4.12.1 (Deleted)

4.12.2 (Deleted)

4.13 REMOTE MANIPULATOR SYSTEM

4.13.1 RMS Hardware Preparation Process

The following RMS Integration Office process is followed for preparing all RMS equipment for flight:

a. The RMS Integration Office is responsible for verifying that all RMS equipment is certified for flight prior to installation. S&MA query the certification database to verify that all the RMS hardware that is to be installed on the Orbiter is certified. If any hardware should indicate open certification, the RMS Integration Office will provide the necessary information to certify the hardware.

b. The RMS Integration Office is responsible for verifying all open failures that have occurred on RMS equipment during flight or testing. The Failure Analysis Reports (FARs) for review and approval by RMS Integration have been closed.

c. The RMS Integration Office is responsible for reviewing and concurring that all OMRSD requirements and processing procedures have been completed with no anomalies and/or the anomalies have been properly dispositioned. RMS Integration coordinates with KSC any OMRSD requirements and procedures that may have encountered any anomaly during checkout and testing. Any dispositions are also coordinated for review and concurrence.

d. The RMS Integration Office is responsible for verifying that all RMS specific flight rules and crew procedures that are mission specific have been reviewed and approved.

e. The RMS Integration Office is responsible for verifying that the flight–specific analyses are within the RMS certified performance envelope. The RMS Integration Office coordinates the review of the flight–specific analyses provided by RMS MOD and provides concurrence or any comments to the analyses.

f. The RMS Integration Office is responsible for verifying that the flight–specific software has been verified and released. The RMS Software Functional Manager reviews and approves any RMS flight specific software and/or any flight software changes.

g. The RMS Integration Office is responsible for reviewing and approving all waivers that may pertain to the RMS flight–specific equipment.

h. The RMS Integration Office is responsible for verifying that all hazards are closed and approved.

4.12.2 FEPC Deliverables

FEPC Deliverables

1. BARS–04 Report accompanies lockers to KSC – Generated by BNA and provided to FEPC. Quality writes in the part number and serial number as applicable, and stamps off the BARS–04 Report as hardware is placed into the lockers. This report is verified against the current CCCD.
2. JSC Form 1027's – Generated to indicate hardware is flight–ready, required per JSCM 5312,QAI–12.
3. Mission–Unique launch Delay Document – Generated by FEPC and provided to KSC.
4. Food Drawing – Generated by FEPC and provided to the NASA subsystem manager.
5. Stowed Clothing – Generated by FEPC and provided to the crew representative.
6. EMU Flight Data Books – Generated by FEPC and delivered to the NASA subsystem manager.
7. EMU Stowage List – Generated by FEPC and provided to NASA.
8. GFE Time/Life/Cycle (JSC–24397) requirements.
9. Landing Site Disposition Report (JSC 16768/JSC 17768, Payload Equipment Landing Site Dispositioning Manual).

4.13 REMOTE MANIPULATOR SYSTEM

4.13.1 RMS Hardware Preparation Process

The following RMS Integration Office process is followed for preparing all RMS equipment for flight:

a. The RMS Integration Office is responsible for verifying that all RMS equipment is certified for flight prior to installation. S&MA query the certification database to verify that all the RMS hardware that is to be installed on the Orbiter is certified. If any hardware should indicate open certification, the RMS Integration Office will provide the necessary information to certify the hardware.

b. The RMS Integration Office is responsible for verifying all open failures that have occurred on RMS equipment during flight or testing. The Failure Analysis Reports (FARs) for review and approval by RMS Integration have been closed.

ATTACHMENT II

AVIONICS AND SOFTWARE FLIGHT PREPARATION PROCESS PLAN

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ATTACHMENT II

AVIONICS AND SOFTWARE FLIGHT PREPARATION PROCESS PLAN

1.0 FLIGHT SOFTWARE AND INTEGRATED AVIONICS PROCESSES

While Appendix R delineates the responsibilities and the level of participation of the SFOC, Appendix A chronicles how Certification of Flight Readiness is achieved. Therefore, for details regarding the actual flight preparation process, Appendix A should be consulted.

1.1 FLIGHT SOFTWARE

This section addresses the FPP of the Space Shuttle Vehicle Engineering Office for preparing the Flight Software (FSW) for a specific mission. To provide an overview of the complete software preparation process, this section also summarizes the activities of other organizations in support of the Space Shuttle Vehicle Engineering Office. (See Appendix G for the MOD specific software process.)

1.1.1 Space Shuttle Vehicle Engineering Flight Software Activities

Software interface requirements between the Orbiter and payload are documented in PIP, Annex 4 and used for the review of compatibility with Orbiter's services, PIP/ICD, and payload inputs. Data are controlled and approved through the Shuttle Avionics Software Control Board (SASCB).

All payload Data Change Requests (DCRs) change established payload requirements, are reviewed for compatibility with the PIP and the payload ICD. Additionally, all cargo bay/mission integration DCRs are reviewed to ensure compatibility between flight software, vehicle, and payloads that are manifested on a mission. Flight software discrepancies, if any, are identified for resolution and disposition by the SASCB.

Input: DCRs; PIPs; payload ICDs; Command and Data Annex – 4.

Output: DCR recommended disposition at the SASCB.

All Systems Management (SM) DCRs are reviewed to ensure that the SM FSW requirements being baselined/updated by the DCR are consistent with the SM generic FSW requirements as defined in the Level B SM Computer Program Development Specifications (CPDSs). In addition, all vehicle/vehicle–element integration DCRs are reviewed to ensure compatibility between the SM reconfigurable data and the vehicle configuration. All SM build specification DCRs are also reviewed to document "as flown" mission build configuration for historical record.

Input: DCRs.

Output: DCR recommended disposition at the SASCB.

Vehicle–Occurrence (VOC) DCRs are developed to reflect the necessary data attributes and signal characteristics associated with hardware on a given vehicle, including definition of generic and unique calibration coefficients where necessary. When a vehicle is selected for a particular flight, a Mission–Definition (MDF) DCR is prepared which links the manifested hardware elements through the use of previously approved vehicle–occurrence DCRs. These MDF and Mission Occurrence (MOC) DCRs are reviewed to ensure all vehicle hardware changes (e.g., LRU changeouts) and software changes affecting data signals have been incorporated appropriately.

Input: Transducer data packs.

Output: Transducer calibration coefficients; VOC, MDF and MOC DCRs; DCR recommended disposition at the SASCB.

PASS and BFS requirements are established and documented based on program direction on an Operational Increment (OI) basis. Additional changes or FSW discrepancy corrections necessary for a particular flight are documented through software CRs and DRs approved by the SASCB. Page change notices to the baseline documents are released as deemed appropriate. The BFS PRDs, as specifications, are released separately through the engineering order release system.

Input: SASCB approved CRs.

Output: CPDSs Functional Subsystem Software Requirements (FSSRs); PRDs; CRs.

I–Load owners select the I–Loads required for flight. These selections are compared to the preliminary mission–definition DCR, and any differences are resolved. In parallel, evaluations are performed to ensure that the integrated I–Load selections work well together and that new I–Load values support mission objectives and satisfy system constraints.

Input: Hardware configuration and mass properties (TDDP and Shuttle Operational Data Book); FDRD; groundrules and constraints; flight rules; crew procedures which affect the way the Shuttle is flown.

Output: I–Load selection and comparison report; I –Load recommended disposition at the SASCB.

All SSME software RCNs, applicable for a certain flight are reviewed for compatibility with Orbiter/SSME interface requirements. Verification is accomplished that SSME FSW requirements have been implemented in flight documentation, discrepancies with Orbiter/SSME interface have been dispositioned, and all applicable integrated verification testing has been successfully completed.

Input: RCNs; Software Authorization Notices (SANs).

Output: SSME software changes recommended disposition at the SASCB.

Revisions to the PASS/BFS ICD are based on FSW CRs approved by the SASCB. Applicable CRs are incorporated and ICD release is made on an OI basis.

Input: SASCB approved CRs.

Output: PASS/BFS ICD.

The program contractor compares the I–Load selections approved for a given flight by the SASCB with those listed in an I–Load data set used by the Software Reconfiguration Facility in production of the Mass Memory Unit (MMU) for a given flight. The I–Loads which have not flown before are audited to ensure they are implemented correctly. On the first flight of an OI, a complete audit is performed of all I–Loads to ensure that the values are good and that the right measurement/stimuli identifications/parameters are provided to the software reconfiguration team.

Input: Approved I–Load DCRs; I–Load data set.

Output: Audit results are provided in support of the Software Readiness Review (SRR).

Any FSW discrepancies found during testing or desk analysis are reviewed for technical impacts and resolution of corrective actions. The DRs and DR management disposition forms are distributed to responsible engineers for impact review. All software DRs are dispositioned prior to flight.

Input: FSW DRs; DR management forms.

Output: DR closure evaluation and recommended disposition at the SASCB.

An FSW briefing is prepared for each flight which summarizes all Orbiter FSW, SSME software, and Launch Processing System software changes for each flight; summarizes the new program notes and waivers since the last flight as well as new Severity 1 or 2 DRs since the last flight; and summarizes the SAIL and SPF testing planned/completed for this flight along with the estimated completion dates. A summary is prepared of any issues resulting from the I–Load audits for this flight.

Input: OI XX PASS and BFS FACI, and OI XX PASS and BFS CI briefings; on–line Management Information Network data base CR and DR status information; STS XX SAIL accountability briefing; STS XX SAIL test requirements document; SASCB minutes; SRR briefing.

Output: Software Readiness Review briefing.

1.1.2 MOD FSW Activities

MOD will perform insight and surveillance on assigned contractor managed functions and/or processes as it pertains to flight software requirements generation and assessment, and mission reconfiguration. These activities include:

a. Facilitating development of the build specification requirements and ensuring the contractor–supplied MMU is compliant with the requirements baselined in the vehicle cargo systems/MMU build specification.

b. Ensuring primary and backup flight software CRs and DRs are reviewed for applicability and severity for the missions; appropriate code changes have been implemented; and DRs are closed/resolved or downgraded.

c. Verifying an audit has been performed on the flight cycle/One–Cycle–to–Flight (OCTF) I–Load data set and all anomalies have been closed/resolved.

d. Ensuring the contractor is compliant with flight software OI and mission requirements in the definition and design of I–Loads.

e. Ensuring the contractor configured and operated SPF is ready to support the mission.

Additionally, MOD will perform oversight review on all assigned new development software or I–Loads, and will ensure through surveillance that all out–of–family issues are closed for flight.

MOD will appropriately disposition all Recon FSW DRs for a given flight in support of flight readiness.

The PIP Command and Data Annex – 4, integrated schematic, and Cargo Engineering Mission Configuration Plan flight products are reviewed and verified for consistency. Any differences are resolved.

MOD ensures that special procedures or flight rules required for this mission due to: (1) vehicle problems that the program elected not to fix, but fly "as is" and (2) ground problems that were not corrected but procedurally worked around have been defined, reviewed by cognizant organizations, verified in man–in–loop simulators, and approved for use.

1.1.3 Engineering Directorate FSW Activities

Engineering will ensure that all primary and backup FSW CRs and DRs are reviewed for applicability and severity to the mission, that those which require disposition prior to flight are identified, and that proposed corrective actions are presented to the SASCB for its dispositioning. Engineering will perform oversight review of all assigned new development or non–transitioned software changes and will ensure through surveillance that all out–of–family issues have been dispositioned by the SASCB. The results of engineering support will be reported regularly through the SASCB and confirmed at the SRR for each Shuttle flight.

Input: DR management forms, CRs

Output: Corrected FSW, waivers, program notes

Engineering will perform surveillance on all FSW code changes not created by the OI–based set of reconfiguration tools. These code changes will be created and provided by the FSW contractor. Engineering will review the contractor's verification test results and will report completion of reviews to the Avionics and Software Office (ASO) in support of software deliveries. The software tools needed to develop either the new capabilities or the OI software base and its OI–based compatible set of reconfiguration tools are under configuration control of the SASCB using two formally tracked change instruments: CRs and DRs. Detailed procedures and processes are defined in the following documents and CRs:

a. NSTS 08271, Flight and Ground Software Verification and Validation Requirements

b. CR 89051, SASCB Shuttle Software Change Request Processing

c. CR 89052, Space Shuttle Flight Software Discrepancy Report Procedures

d. CR 89057, SASCB Flight Software Application Tools Process

In order to process and implement the disposition of CRs and DRs from the SASCB, the ASD has been delegated the responsibility of two secondary control boards:

a. Test and Operations Board

b. Support Software Change Control Board

Detailed procedures and interfaces for these boards are defined in the following documents:

a. JSC 22320, Flight Software Class 1 Integration Plan

b. JSC 24954, Flight Software Build Specification ICD

c. JSC 08338, Orbiter Avionics Mass Memory Unit Computer Program Integration Plan

d. JSC 25392, Flight Software Test and Operations Plan

In addition, the primary software contractor's supporting processes are defined in SFOC–PASS–002, Space Shuttle Orbiter Avionics Software Management Plan, and SFOC–PASS–001, Space Shuttle Orbiter Avionics Quality Assurance Plan. The backup software contractor's supporting processes are defined in the BFS Software Standards and Procedures Manual.

Input: CRs; DRs.

Output: Upgraded OI.

1.1.4 SFOC FSW Activities

SFOC delivers the SDTs, MMUs, and associated software data products defined in the Data Integration Plan and mass Memory Integration Plan (MIP) to associated NASA organizations and contractors for use in launch and mission support activities. SFOC delivers the build specifications with the SDTs for technical reference. SFOC executes an appropriate QA plan and maintains all required records.

SFOC generates and delivers all associated MCC and MMU products. SFOC ensures all MCC reconfiguration requirements are satisfied, along with data verification. SFOC ensures that all MMU reconfigurations are certified. SFOC executes an appropriate QA plan and maintains all required records.

SFOC ensures that the SPF is ready to support the mission. SFOC verifies all critical hardware and software is properly configured for this mission, requirements are satisfied, tested, verified, and certified for flight. SFOC executes an appropriate QA plan, and maintains all required records.

1.1.5 Integrated Avionics Verification

All avionic systems changes (CRs, DCRs, DRs, Master Change Records [MCRs], RCNs, and PRCBDs), the mission profile, and planned avionics system usage are assessed to determine verification test requirements for each flight. These verification tests may utilize the SAIL, SPF, and Cargo Integration Test Equipment (CITE) facilities and may include desk analyses. Test requirements for all flight phases and functional areas are coordinated and baselined at the SASCB.

After baselining, detailed test and data requirements are developed and defined in the Test Requirements Document and the Data Requirements Document, respectively.

Input: SAIL test configurations, facility modification status

Output: Facility accountability reports, site acceptance reports

Test design reviews are held to verify that SAIL tests can be properly supported by the SAIL facility. The SAIL facility modifications required to support testing are also identified, followed by site acceptance testing when modifications are completed.

Reviews are performed to ensure proper implementation of requirements into the detailed SAIL test and check–out procedures. Test sponsors monitor realtime data and conduct pre–test and post–test meetings. Test results are accepted for data by the integration contractor test sponsor, and any anomalies noted realtime are documented by SAIL IDRs for subsequent resolution.

Test data are then analyzed to verify system compliance, and IDRs are reviewed to ensure no constraints to flight exist. A Verification Accountability Report is presented to the SASCB prior to the FRR. A test report documents final analysis results.

Input: Avionics systems changes (CR/DRs, MCRs, RCNs, etc.); mission profile (FRD, DTOs, etc.); mission data (DCRs, I–Loads, etc.).

Output: Test requirements matrix and document; data requirements matrix; FSW verification accountability reports; integrated avionics verification test and analysis reports; integrated avionics Pre–FRR/CoFR inputs.

CITE test data pertaining to vehicle and payload Telemetry Format Load (TFL)/ Decommutator Format Load (DFL) configuration testing are reviewed to ensure telemetry lock is maintained and meets the baselined payload management FSW requirements and the PIP Command and Data, Annex – 4 requirements. Remaining vehicle telemetry configurations are verified at the SAIL during testing of the applicable OI.

Input: CITE test data payload management software changes; operational maintenance inspection data.

Output: STS–XXX TFL/DFL configuration verification results.

Prior to each flight, a review of open SAIL Interim Discrepancy Reports (IDRs), problem reports, and IFAs is performed to ensure all problems have been satisfactorily dispositioned and that there are no constraints to flight. The results of this review are presented to the SASCB as part of the Verification Accountability Report in which the disposition of each flight–related problem is presented.

Input: SAIL IDR listings; SAIL test data; flight anomalies; problem reports.

Output: FSW verification accountability report inputs; integrated avionics verification test and analysis report inputs.

1.1.6 Independent Verification and Validation (IV&V) FSW Activities

A multidisciplinary systems perspective to identify safety problems that might otherwise go unrecognized is performed by an independent contractor throughout the ongoing flow of FSW changes and anomalies. Focus is on FSW problem reporting and change instruments (CRs and DRs for the General Purpose Computer [GPC] software and Requirements Change Notices [RCNs], DCNs, and Code Change Notices [CCNs]) for the SSMEC software. The IV&V analysis takes into account the effect on interrelationships with other elements of the avionics to which the FSW interfaces and with onboard systems in general as well as with crew and ground procedures. This process adds the value of independent technical insight deriving from in–depth understanding of the nature and ramifications of these problems and changes. A risk assessment is performed on all in–scope problems and changes to determine the level of analysis (limited, focused, or comprehensive) to be performed. Categories of problems or changes that are considered out–of–scope are those dealing exclusively with Vehicle Utility (VU) software, SM/payload software and software development tools.

a. A limited analysis is performed on all simple in–scope changes and problems not requiring code changes. The limited analysis exposes problems and aids the SASCB in approval decisions by assessing the appropriateness of the proposed disposition and rating the inherent safety risk in the problems and the risk of making a change.

b. A focused analysis is performed on all in–scope nontrivial code changes affecting critical GN&C, data processing system sequencing, or SSMEC software that is delivered to NASA. The focused review includes:

   1. A detailed design/code analysis to determine if the software design and implementation satisfy the baselined requirements and, equally important, that there are no unintended consequences of the implementation.

   2. A test analysis to look for deficient tests, anomalous results, and holes in test coverage.

c. A comprehensive analysis is performed on any in–scope change that is especially critical, complex, or risky; involves significant system impacts beyond the software; or cannot be thoroughly tested during software verification. For a comprehensive analysis, IV&V evaluates integration testing (Level 8 and SAIL) for the additional coverage they provide and confirms any changes to Shuttle Systems, crew, and/or ground procedures that may accompany a software change. These activities are in addition to the usual focused review.

Input: Change paper; requirement/design/code/test documentation; procedures.

Output: Software IV&V report.

All user notes or waivers issued to close a DR or RCN/DCN are reviewed for clarity, coverage, and accuracy by the IV&V contractor.

Input: DR; RCN; DCN; user note; waiver.

Output: Software IV&V report.

Issue–tracking reports are submitted for identified non–safety issues which might affect FSW maintainability or FSW development processes.

Input: Change paper.

Output: Issue–tracking reports.

1.1.7 SR&QA/Space Shuttle Division FSW Activities

SR&QA performs surveillance of FSW change activities to provide the ASO an assessment of any safety risk changes. Technical evaluations and risk assessments are performed for each CR that will result in a change to the FSW. Requirements inspections are attended and the data obtained is used to assist in providing an accurate assessment of any impact to safety. All DRs are reviewed with a technical evaluation and risk assessment performed for the DRs with a severity of 1, 1N, 2, 2N or 3. The verification testing of flight–specific software source and patch changes is reviewed to ensure accurate implementation of the approved requirements.

SSME CRs are reviewed for FSW compatibility. All FSW interfaces are evaluated and assessed for safety impacts. Existing hazard, CIL and flight rules are also reviewed to identify any required documentation updates based on approved FSW changes. Verification of reconfiguration QA processes associated with each mass memory release is also performed.

Input: Change documents (CRs, DRs, SSME CRs), requirements/test documentation

Output: Recommended approval/disposition of change documents at the SASCB, risk assessments

1.1.8 Flight Software Readiness Review

All applicable software products for this flight are statused as complete or open standard work at a Flight Software Readiness Review. Any issue identified is reviewed and corrective action plans, where necessary, are established to be completed prior to launch.

a. The flight software contractor's specific items to report on for PASS and BFS are: (1) applicable DRs since the last flight; (2) new waivers, operations notes, and user notes required for flight; (3) flight approved CR and DR changes to the OI software; (4) verification testing on approved CR and DR changes delivered for use with the OI software; (5) reconfiguration and Level 8 testing of the flight system software; (6) applicable DRs against reconfiguration tools, SPF simulators, and HAL compiler. Flight software changes required after the final load is complete are delivered via patches. These changes are approved by the PRCB and follow the same process as regular code deliveries.

   Prior to reporting flight readiness, the contractors have ensured that

   – all products as required by the Class 1 Integration Plan, the MMU Integration Plan, the Reconfiguration Performance Test Plan; and by contract have been delivered

   – all Reconfiguration and Verification applicable to this flight has been successfully completed

   – all flight software discrepancies which impact this flight have been resolved, reviewed, corrective action approved by NASA and have been closed.

Input: Software; CRs; DRs; waivers; operations notes; user notes.

Output: SRR briefing; flight readiness statement.

b. The reconfiguration requirements contractor's specific items to report on are: (1) SDTs; (2) reconfiguration requirements activities; (3) comparison of engineering drawings; (4) SPF; (5) new or updated special procedures or flight rules since last flight.

Input: Upgrade OI software; DCRs; PIP Command and Data Annex – 4; integrated schematic; Cargo Engineering Mission Configuration Plan; DRs.

Output: SRR briefing; flight readiness statement.

c. The independent contractor's specific IV&V items to report on are: (1) PASS; (2) BFS; (3) SSMEC software; (4) DRs; (5) CRs; (6) logic change notices; (7) operational data that have flight safety–related implication.

Input: PASS/BFS software; SSMEC software; all change paper; waivers; operations notes; user notes.

Output: SRR briefing; flight readiness statement.

d. SSME Project's specific items to report on are: (1) SSMEC software; (2) interface issues.

Input: SANs; RCNs.

Output: SRR briefing.

e. KSC/Integration Office's specific items to report on are: (1) Ground system software; (2) Interface issues.

Input: Launch processing system software changes.

Output: SRR briefing.

1.2 FLIGHT READINESS STATEMENT

All applicable products and testing for each flight are statused as complete or open standard work at the SASCB. Any issue identified is reviewed and corrective action plans, where necessary, are established to be complete prior to launch. Exceptions to requirements are identified and noted.

Input: Integrated avionics verification requirements.

Output: Integrated avionics readiness statement.

APPENDIX B

EVA PROJECT
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX B

EVA PROJECT
FLIGHT PREPARATION PROCESS

1.0 INTRODUCTION

The EVA Project Office FPP requires an EVA Flight Readiness Statement from the following divisions: Crew and Thermal Systems Division; Medical Sciences Division; Flight Crew Support Division; Manufacturing, Materials and Process Technology Division; Automation and Robotics Division; Solar Systems Exploration Division; EVA, Robotics, and Crew Systems Operations Division (MOD); Shuttle Safety and Mission Assurance; and SFOC.

The above–listed organizations are responsible for a list of hardware or other products unique to EVA. Each respective organization provides an EVA Readiness Endorsement that certifies that the completed activities and remaining open work required for flight of the Space Shuttle Vehicle, flight crew, and payloads, as defined by baselined SSP requirements and documentation, have been reviewed and approved.

Each respective organization is responsible for a select number of requirement codes and their endorsement certifies readiness for a particular mission, contingent upon closeout of any exceptions noted on Figure B–1, which is signed after the EVA Project Flight Readiness Review (FRR).

While Appendix B delineates how CoFR is achieved, Appendix R defines the products and processes of SFOC to ensure flight readiness.

FIGURE B–1

EVA PROJECT FLIGHT READINESS STATEMENT

RESPONSIBILITY	NASA	DATE
EVA Support Tools, EMU Life Support and Space Suit Assemblies, Contingency EVA Tools a thru r, x thru z, aa thru cc	Crew and Thermal Systems Division	
Medical Equipment, Medical DSOs (EVA Applications) a thru r	Medical Sciences Division	
EVA Cameras, Training Facilities, CCCD a thru r	Flight Crew Support Division	
SFOC a thru r		
SAFER (for missions when manifested) a thru r	Automation and Robotics Division	
Materials a thru r	Manufacturing, Materials and Process Technology Division	
Radiation Measurement Devices (EVA Applications) a thru r	Solar Systems Exploration Division	
EVA Procedures, Timeline, Training, Flight Rules s, t, u, v, and w	Mission Operations Directorate, Systems Division	
EVA Safety Summary dd, ee, and ff	Shuttle Safety and Mission Assurance	

NOTE: The following requirement codes are applicable to the EVA Project Flight Readiness Review process.

2.0 EVA PROJECT

The EVA Project Office FPP includes, but is not limited to, the following responsibilities:

a. Any exceptions listed from prior reviews, or actions from applicable readiness reviews, which constrain flight readiness, are resolved.

b. Constraints for flight readiness are identified and scheduled for completion or resolution.

c. Waivers, deviations, exceptions, and restricted hardware dispositions are acceptable for flight readiness.

d. Problems, unexplained anomalies, and In–Flight Anomalies (IFAs) are evaluated and documented as acceptable for flight readiness.

e. Personnel actively participating in hardware processing are trained and/or certified.

f. Flight hardware requirements are defined in released engineering and documentation.

g. “As–built” flight element configuration satisfies the released requirements and engineering.

h. Flight hardware certification is complete.

i. Flight hardware is within time, cycle, age life, interval inspection, and maintenance requirements.

j. Flight hardware discrepancies and problems are reviewed and dispositioned with remedial action or approved as acceptable for flight.

k. Safety analysis/reports are complete, identified hazards are closed, Critical Items List (CIL) retention rationale are accepted, and ALERTs are reviewed and do not present a constraint to flight readiness.

l. Flight crew procedures are reviewed and concurred upon for flight.

m. All significant differences from previous flights are reviewed, and where required, are incorporated into applicable documents.

n. A project readiness review was satisfactorily completed.

o. Necessary safety analysis, materials tests, certification requirements, and flight readiness requirements are completed.

p. All equipment defined in Crew Compartment Configuration Drawings (CCCDs), plus Drawing Change Notices (DCNs), Mission Equipment Cargo Support

Launch Site Installation Drawings, and/or the crew equipment list the EVA Project Office is responsible for, is processed for flight by approved procedures.

q. All equipment changes approved by the EVA Configuration Control Board and the EVA Hardware Board are incorporated.

r. All changes or deviations to critical processes in equipment preparation are reported.

s. The flight crew training and certification for performance of all scheduled, unscheduled, and contingency EVA requirements is reviewed and approved.

t. The published procedure verification matrix for all scheduled, unscheduled, and contingency EVA scenarios are reviewed and approved.

u. All finalized and published EVA checklists are reviewed and approved.

v. All finalized and published EVA flight rules are reviewed and approved.

w. All MOD EVA open issues and related anomalies are evaluated and closed, or dispositioned as acceptable for flight.

x. A realtime mission support plan is published and distributed to key personnel — scheduled EVA missions only.

y. The EVA Annex 11 (if required) is approved and published thru the Integration Control Board process.

z. All Flight Data File–documented EVA scenarios and hardware applications are reviewed and verified to be within accepted certification limits (i.e., structural limit loads).

aa. Engineering training hardware is verified for flight–like accuracy. Any known discrepancies or shortcomings are identified to MOD training personnel and the flight crew.

bb. A summary of new/unique EMU hardware items and/or configuration changes have been identified to MOD training personnel and to the flight crew.

cc. The EMU hardware installation (V1103) schedule has been properly coordinated with KSC flow managers.

dd. All scheduled, unscheduled, and contingency EVA scenarios and required support hardware have been reviewed and certified as safe for flight.

ee. All safety hazard reports and required safety analyses have been published and distributed to key personnel.

ff. The System Safety Review processes have been completed according to normal procedures.

3.0 ACTIVITIES LEADING TO THE EVA PROJECT FRR

The activity leading to the FRR of the EVA Project constitutes an important part of the preparation for flight. These activities are:

a. The EVA Project Configuration Control Board (CCB) – The CCB establishes baseline EVA concepts for each mission, reviews major hardware design development and changes, and assesses EVA readiness for flight.

b. Regular progress reviews with the performing organizations.

c. The EVA Hardware Board (EHB)is responsible for authorizing approved hardware–related efforts, and operates under the authority of the EVA Project CCB. The EHB provides a method for evaluating and authorizing hardware configuration changes, as well as implementing the detailed EVA GFE items which are required to carry out the mission objectives which are specified in the Flight Requirements Document (FRD), implementation plans, or other Program–level documentation. The EHB serves as a forum for presenting and resolving technical issues, proposals for hardware improvements, and providing and controlling specifications used for the design and test of EVA hardware.

4.0 FLIGHT PREPARATION PROCESS

The flight management process is intended to ensure that flight hardware and software will be designed, developed, and tested. The following divisions are involved in the process.

4.1 SAFETY, RELIABILITY, AND QUALITY ASSURANCE

4.1.1 Hardware Preparation Process

The following SR&QA Division process is followed for preparing hardware for flight and for EVA safety assurance:

a. SR&QA tracks all exceptions and actions until final resolution. In addition to the FRR process, constraints for flight readiness would be reported to the SR&QA Prelaunch Assessment Review (PAR) and FRR Tag–up held with other SR&QA organizations at NASA Headquarters, MSFC, KSC, and other centers/contractors, as appropriate.

b. The SR&QA organizations from the various centers have a closed–loop coordination system which includes the PAR process listed in the above response. While SR&QA may not be the originators of the final resolution, the action is tracked and reported on at various meetings such as the open problems and certification presentations at the EVA Project CCB and EVA Hardware Board, as well as the PAR and FRR Tag–up meetings.

c. All waivers, deviations, exceptions, and restricted hardware dispositions are tracked in the certification process. Approval by all affected parties is required before flight approval (and release for flight shipment) is granted.

d. SR&QA has a closed–loop system for tracking all problems, including IFAs and unexplained anomalies. The problem reporting system is maintained by the SR&QA organization who also must make a recommendation on the closure of IFAs and unexplained anomalies, and provides a signature approval for all problem reports.

e. All SR&QA engineers/quality specialists have individual training plans maintained in an automated data base. Certification is limited to quality process–procedures and/or item handling. All certification is completed and noted in the engineer/quality specialist records with a high priority for completeness prior to use requiring it. Special training and certification are accomplished and maintained for verification of soldering and welding processes.

f. All Government Furnished Equipment (GFE) hardware requires a Program Requirements Document (PRD) or equivalent, containing the data specified in NSTS 07700, Volume VI, Flight Support Equipment (FSE) Management. The PRD for the hardware being developed/approved for flight will be reflected in the Change Request (CR) authorizing development/changes/stowage of the item for flight and also in the final flight certification documentation.

g. The Quality Assurance organization verifies that the hardware conforms to the released engineering documentation and is the as–built configuration. The SR&QA flight certification documentation requires a part (dash) number of the test unit and flight unit. If there are any differences between the two (dash) numbers, satisfactory rationale must be provided. NSTS–07700–10–MVP–01, Shuttle Master Verification Plan, Volume I, General Approach and Guidelines, states that any changes that effect form, fit, function, safety, or reliability requires recertification (rolling a dash number).

h. SR&QA maintains a GFE certification data base where all hardware scheduled for a flight is identified. This data base has flight effectivity, certification status, limited life data, Failure Modes and Effects Analysis (FMEA) number and additional information. It is electronically compared against the Baseline Accounting Reporting System (BARS) and Mission–Unique Processing Plan (MUPP) reports to ensure the manual inputs did not overlook anything. Charts with the certification status are presented at the EVA Hardware Board and at the EVA Project FRRs.

i. Safety and Mission Assurance (S&MA) maintains a listing of all limited life time/cycle GFE in the certification data base. Quality Assurance and the SFOC contractor track each serial number (S/N) item with limited life. The SFOC contractor has an automated tracking system that lists all limited life dates of each serial number item in their purview. S&MA checks with Quality Assurance and SFOC and reports on the limited life status at the FRR.

j. SR&QA maintains a closed–loop problem reporting system. All problems and discrepancies must be closed, or a satisfactory disposition made before the hardware can be shipped from JSC. Open problem issues require approval of the Chief, Institutional Safety and Quality Division prior to shipment.

k. Safety/analysis reports are part of the certification process. Hardware cannot be shipped with an open certification paper without approval of the Chief, S&MA Division. Hazards, CILs, and Acute Launch Emergency Reliability Tips (ALERTs) status are reported to the management at the PAR, FRR Tag–up, SR&QA Project Schedules Meeting, and the EVA Project FRR.

l. SR&QA has a focal point for review of flight crew procedures. This focal point sends out notification of availability of these procedures on the Local Area Network (LAN) to the SR&QA community prior to each flight requesting comments.

m. SR&QA reviews and prepares flight certification for hardware changed from previous flights. Contingency and planned EVAs are also reviewed/assessed for mission success and safety for each flight.

n. EVA safety personnel participate in the EVA Support Review Panel, Flight Techniques Panel, crew training (neutral buoyancy trainers, simulations, etc.), and present issues and hazards to the Systems Safety Review Panel (SSRP) and Payload Safety Review Panel (PSRP).

o. JSC has a closed–loop hazard reporting system that requires a lengthy process prior to being baselined as a hazard. All hazards are presented to the SSRP and/or the PSRP, as noted above, as well as to the EVA Project FRR.

p. SR&QA conducts PARs and FRR Tag–up meetings for each flight.

q. All required testing, analysis, and certification is completed and documented in the certification records for each flight.

r. SR&QA has no responsibility for hardware processing procedures at the SFOC facility other than a resident Quality Representative. However, for hardware checked out by OMRSD and for other JSC–provided hardware, the verification process includes procedure approval. The CCCD is also electronically compared by the certification data base to verify that all hardware is approved for flight, except for turnaround checkout.

s. All Configuration Control Board Directives (CCBDs) are logged into the certification data base as soon as possible following approval. Required action is tracked and reported at the CCBs and other meetings as appropriate. Final certification approval is required prior to closure in the data base.

t. All changes or deviations to critical processes in equipment preparation are monitored by members of the SR&QA community as appropriate.

4.2 MANUFACTURING, MATERIALS, AND PROCESS TECHNOLOGY

4.2.1 Hardware Preparation Process

JSC materials certification is required to document that flight hardware has been evaluated for compliance with JSC GFE Materials and Processes (M&Ps) requirements. These requirements include flammability, toxic offgassing, thermal vacuum stability, corrosion, stress corrosion cracking, age life, fracture control, etc. Other M&P requirements include functional compatibility in various environments, as applicable. Compliance with these requirements is evaluated by test and/or analysis.

4.2.2 EM Products Produced for EVA Hardware

a. Material certifications

b. MUA

c. White Sands Test Facility (WSTF) test requests

d. WSTF test results

e. Failure Analysis Reports

f. Contamination Analysis Reports

g. Fracture Control Summary Reports

h. Manufacturing process specifications

i. Fabrication of flight and prototype hardware

j. MAPTIS materials data base updates

k. OCCPs for ground testing of pressurized flight hardware

4.2.3 Documents Reviewed and Approved by EM for EVA Hardware

a. Certificate of Flight Readiness (CoFR) — FRRs and individual flight hardware

b. JSC flight hardware drawings (and DCN)

c. CCB Change Requests

d. Safety Analysis Report (SAR) Addenda

e. Flight hardware Discrepancy Reports

f. Safety and Mission Assurance Certification Approval Request (SMACAR)

g. Nonmetallic Materials Usage Logs for JSC chamber tests

h. Test Readiness Reviews

i. PRD short forms

j. Fracture Control Plans

k. Materials Control Plans

4.2.4 Other EM Support for EVA Hardware

a. Overall JSC GFE materials control management

b. Materials selection and design support

c. Materials shelf life extension

d. Board membership on EVA Hardware Board

e. Presentation of flight materials certification status at EVA Project FRRs

f. Review of EVA hardware requirements documentation

g. Support at PDRs, CDRs, and other hardware reviews

h. Approval of component test plans and reports for Assured EMU Availability Life Extension Program

i. Interpretation of WSTF test results

j. High pressure oxygen and propellant system analyses

k. Nondestructive testing and evaluation

l. Material chemical and physical property tests

m. Flight experiment development

n. Advanced materials and processes development

o. Pressurized hardware safety support

p. Fracture control implementation

4.3 EARTH SCIENCE AND SOLAR SYSTEM EXPLORATION

The following Earth Science and Solar System Exploration process is followed for preparing hardware for flight:

a. STS flight dosimeters are provided as crew equipment to meet the operational, medical, and regulatory radiation measurement requirements for manned space flight, and are certified for flight readiness for EVA applications at the EVA Project FRR prior to each flight, as appropriate. Drawings, certification documentation, and detailed laboratory assembly/processing procedures are maintained by the JSC Radiation Dosimetry Laboratory.

b. Passive dosimeters are reassembled with screened Thermoluminescent Dosimeter (TLD) chips and the pocket chambers are screened and reset to zero for each flight. Prior reviews/actions deal only with measurement quality. Failed or unreliable dosimeters are eliminated from flight category and flight readiness for next flight should not be impacted by any prior actions.

c. The only constraint to flight readiness for dosimetry is the assembly and delivery (to SFOC) schedule. Routine laboratory procedures satisfy this requirement.

d. Personnel operating the JSC Radiation Dosimetry Laboratory are required to be trained and experienced by job description and/or contract stipulation.

e. Radiation dosimetry flight hardware requirements are reviewed and implemented by the JSC Radiation Constraints Panel (RCP) as part of its charter. Requirements are documented in RCP minutes, hardware design certification/ verification documentation, Shuttle medical/crew health requirements, etc.

f. Radiation dosimeter hardware are packed and shipped by SFOC.

4.4 CREW AND THERMAL SYSTEMS

4.4.1 EMU Hardware Preparation Process

The following Crew and Thermal Systems Division (CTSD) process is followed for preparing EMU hardware for flight:

a. Hardware Identification Process Summary

1. After the EVA crewmembers are officially identified for a specific flight, the SFOC selects flight/training hardware that provides the best fit possible.

2. A flight hardware list is generated to identify the specific hardware configuration, as well as serial numbers.

3. Hamilton Sundstrand Space Systems International, Inc. (HSSSI) verifies that all selected configurations are flight authorized.

4. Flight Crew Division manifests the hardware by putting it into the CCCD.

5. SFOC documents hardware for each flight on the short EMU drawing.

b. Requirement Determination Process Summary

1. Any of the EMU community can submit a change to FEMU–R–001 (EMU PRD).

2. These suggestions are normally discussed at the Life Support System (LSS) weekly telecon to decide on further disposition.

3. Recommended changes are submitted in an EVA Project Change Request.

4. If the change request is approved and a CCBD issued, the EVA Hardware Development Office via Technical Direction (TD) directs HSSSI to alter this field controlled document.

c. Hardware Processing Summary

1. SFOC processes the flight hardware in accordance with approved procedures.

2. All performance–related discrepancies are reviewed and concurred upon by CTSD.

3. Once all DRs have been addressed and all processing for flight/chamber test have been completed, the EMU data packages are updated.

d. Crew Training and System Verification Summary

1. SFOC generates test readiness sheets for the Environmental Test Article (ETA) test. This process ensures SFOC to review all open engineering and life limitation issues.

2. CTSD assesses hardware readiness and upon determination/concurrence of readiness, conducts the ETA crew training vacuum chamber run.

NOTE: The ETA chamber run not only trains the flight crew on airlock and EMU operations, but also functionally verifies many EMU performance criteria.

e. Readiness Review Summary

1. Based upon all of the processing to date on the EMU hardware, SFOC presents a package to NASA stating the hardware's readiness for flight (from a processing perspective).

2. HSSSI and CTSD present a package stating the EMU hardware's readiness for flight, from a design perspective.

f. Orbiter Installation and Checkout Process Summary

1. SFOC ships EMU to KSC.

2. SFOC supports Operation and Maintenance Instruction (OMI) V1103.02 (Orbiter to EMU checkout) and OMI V5097 (crew equipment stowage) at KSC.

3. In parallel, HSSSI, representing CTSD, monitors/participates in OMI V1103.02 via communication loops connected to the MOIR.

g. Mission Simulation Support Summary

NOTE: The mission simulation support process and the realtime EVA support process are nearly identical in nature. Therefore, for purposes of summary only, the mission simulation (SIM) will be detailed.

1. Joint Integrated Simulation (JIS) EVA is identified and scheduled.

2. HSSSI publishes a support plan, for either activity, for CTSD approval.

3. Each activity requires that the EVA Operations Room (EOR), (formally called the Mission Support Room), be activated, which HSSSI accomplishes.

4. The JIS EVA is then supported.

h. Postflight Activities Process Summary

1. Data from hardware receiving inspection, realtime monitoring of EVA, and any data obtained during crew debriefs is used to determine if any further activity is required (i.e., postflight anomaly and/or inflight anomaly).

   NOTE: Either of these conditions will result in action being taken and input to the appropriate EMU process in the form of potential corrective action.

2. A flight mission summary for EVA flights only is produced.

APPENDIX C

SPACE SHUTTLE MAIN ENGINE (SSME) PROJECT
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX C

SPACE SHUTTLE MAIN ENGINE (SSME) PROJECT FLIGHT PREPARATION PROCESS PLAN

PREFACE

The purpose of this document is to baseline the processes and procedures as defined by the SSME Project in accordance with NSTS 07700 Volume IV, Configuration Management Requirements, RSS–8503–3, Rocketdyne Configuration Management Plan, FR–19678, Pratt & Whitney Configuration Management Plan, and Contract NAS8–40000 to be accomplished, as a minimum, in order to assure the as–designed, as–built, as–delivered SSME configuration is flight worthy and ready for launch site processing.

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APPENDIX C

SPACE SHUTTLE MAIN ENGINE (SSME) PROJECT FLIGHT PREPARATION PROCESS PLAN

1.0 SSME HARDWARE ACCEPTANCE REVIEW

The SSME Hardware Acceptance Reviews are SSP reviews delegated to the SSME Project. NASA Form DD 250/DD 1149 is executed at this review to certify element hardware has been manufactured according to specifications for acceptance by NASA, and is ready for transfer (primarily from the SSC to KSC) for flight processing.

1.1 ELEMENT ACCEPTANCE REVIEW (EAR)

EAR conducted prior to delivery of complete engines to KSC following initial build, major overhaul, or major reconfiguration in which the element end item is delivered to NASA (DD 250/DD 1149). This review is chaired by the SSME project manager and is supported by the prime contractor, Shuttle Processing, Space Shuttle Systems Integration, MSFC Science and Engineering (S&E), and MSFC Safety and Mission Assurance (S&MA). At the conclusion of this review, a certification statement is signed to attest to readiness of the element end item to be delivered to the launch site for flight processing.

1.2 COMPONENT ACCEPTANCE REVIEW (CAR)

CAR is conducted prior to delivery of components to KSC which require testing prior to final acceptance following component build, repair, modification, or overhaul in which the component end item is delivered to NASA (DD 250/DD 1149). A CAR statement is signed by the SSME project manager or designee to attest to readiness of the component end item to be delivered to the launch site for flight processing.

1.3 AGENDA/PRESENTATION PACKAGE

An Agenda/Presentation package for EARs and CARs will be formatted to include the topics delineated below with emphasis on first–time, first effectivity (out–of–family) changes.

Action items, when appropriate, will be assigned and documented with specific actionee(s) and the required closure date.

a. **Review of Test/Checkout Data**

    1. Hot fire green run requirements

2. Component acceptance test results

3. Prior hot fire data

b. **New Engineering Change Proposals (ECPs), OMRSDs**

1. Review new ECPs

2. Review new OMRSD requirements

c. **Review New Technical Issues**

d. **Review Deviation Approval Request (DAR), Material Review (MR), Unsatisfactory Condition Report (UCR) Status**

1. New/unique DARs

2. Major MRs

e. **Review Certification Status**

f. **Hazards Analysis Update**

1. New failure modes

2. Upgraded hazards from controlled to accepted risk

3. New technical issues

g. **As–Built vs. As–Designed**

h. **Fleet Leader Assessment**

i. **Open Work**

2.0 ORBITER ROLLOUT READINESS REVIEW

The SSME Project will participate in the disposition of all identified out–of–family events occurring during KSC processing, and will immediately notify KSC of any out–of–family problems discovered during manufacturing, development testing, acceptance testing, or data analysis which have the potential of impacting engine processing at the launch site. The SSME Project Office will not normally participate in the Orbiter Rollout Readiness Milestone Review except upon request to support out–of–family event discussions.

3.0 PROJECT FLIGHT READINESS REVIEW

The SSME Project Office will conduct a project FRR to assess all performance predictions. Hardware performance trends from previous flights and/or ground tests will also be evaluated with respect to continued component usage and interchangeability. Tag values will be provided to Space Shuttle Systems Integration Office on a mission–to–mission basis.

4.0 FLIGHT SOFTWARE ACCEPTANCE

The flight software acceptance will be conducted prior to the delivery of flight software to the KSC by MSFC and the prime contractor. Flight software acceptance will be accomplished in accordance with NSTS 07700, Volume IV, Appendices M and X.

5.0 SSP FLIGHT READINESS REVIEW (FRR)

The SSME Project will be available, if required, to support any identified out–of–family events occurring during launch processing. Discussion of out–of–family events affecting a given launch at the SSP FRR will be upon request.

6.0 PRELAUNCH MISSION MANAGEMENT TEAM REVIEW

The SSME Project will be available to support any identified out–of–family events or issues occurring since the SSP FRR.

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APPENDIX D

EXTERNAL TANK PROJECT
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX D

EXTERNAL TANK PROJECT
FLIGHT PREPARATION PROCESS PLAN

PREFACE

The purpose of this document is to baseline the processes and procedures as defined by the External Tank (ET) Project to be accomplished, as a minimum, in order to assure the as–designed, as–built, as–delivered ET configuration is ready for launch site processing and can be certified as flight worthy.

This document further defines the products of these baselined processes/procedures as milestones of accomplishment in a quantitative manner for which verification/certification must be accomplished on each ET prior to the SSP Flight Readiness Review CoFR.

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APPENDIX D

EXTERNAL TANK PROJECT
FLIGHT PREPARATION PROCESS PLAN

1.0 APPLICABLE DOCUMENTS

The following documents are applicable to the extent specified in the External Tank Project Flight Preparation Process Plan and comprise an integral part of the processes and procedures defined herein.

The ET Project builds and flies ETs under the provisions of contract NAS8–36200. This contract defines the requirements for manufacturing, assembly, test, checkout, and delivery of operational flight articles in order to meet the delivery schedule in support of the SSP mission model requirements. This contract, and changes thereto, constitute the requirements necessary to meet the government's contract end time specification. The contract Statement of Work defines the detailed requirements to build and fly Space Shuttle ETs. Noted below are the ET Project and SSP documents that form a part of the Statement of Work.

a. Element Documents

MMC–ET–CM01	Configuration Management Plan
MMC–ET–CM02	End Item Specification (CPT01M09A)
MMC–ET–CM06	Documentation Changes and Revisions
MMC–ET–RA01b	External Tank Hazard Analysis Report
MMC–ET–RA03	Quality, Reliability, and Safety Requirements and Implementation Document
MMC–ET–RA04b	Critical Items List
MMC–ET–RA06	Space Shuttle External Tank Criticality 1, 1R, 2 and 2R Problem Reporting Requirement Plan
MMC–ET–RA07	NASA Alert System Documentation
MMC–ET–RA10	End Item Acceptance Data Package
MMC–ET–SE16	Materials and Processes Control Plan
MMC–ET–SE42	ET Long Term Storage Requirements
MMC–ET–TM01	External Tank Verification Plan
MMC–ET–TM04k	Acceptance Test; Storage and Pre–Shipment Test and Specification Requirements
MMC–ET–TM06	Certification and Qualification

MMC–ET–TM08	Hardware Certification Sheet
MMC–ET–TM09	ET Verification Program Status Report

b. Program Documents

NSTS 07700, Volume IV	Configuration Management Requirements
NSTS 07700, Volume V	Information Management Requirements
NSTS 07700, Volume VIII	Operations
NSTS 08126	Problem Reporting and Corrective Action (PRACA) System Requirements
NSTS 08171	Operations and Maintenance Requirements and Specifications Document
NSTS 16007	Shuttle Launch Commit Criteria and Background Document

2.0 ET HARDWARE ACCEPTANCE AND READINESS FOR MATE REVIEW

The ET Hardware Acceptance and Readiness for Mate Review, as defined in Paragraph 8.5.4, is a SSP review delegated to the ET Project. NASA Form DD 250 is executed at or before this review. It certifies that the ET has been manufactured according to specifications, and has been inspected and accepted by NASA, and further signifies the ET is ready for transfer from the Lockheed Martin Manned Space Systems to the launch site for flight processing.

The ET Hardware Acceptance and Readiness for Mate Review will be conducted by the ET Project and will be chaired by the ET Project Manager or designee. Review participants will include: ET Project, Lockheed Martin Manned Space Systems, Shuttle Processing, Space Shuttle Systems Integration, and S&MA. The review will typically be held at MAF with MSFC/KSC/JSC participation by teleconference. An agenda/presentation package will be formatted to include the topics delineated below with emphasis on first–time, first effectivity (out–of–family) changes baselined since last review.

Minutes will be recorded and filed. Action items, when appropriate, will be assigned and documented with specific actionee(s) and the required closure date.

This review will include the following products/processes as a minimum:

Hardware Element Acceptance Review (HEAR) – Conducted prior to launch, in which the ET End Item is delivered to NASA (DD 250). This review is chaired by the ET Project Manager and is supported by the prime contractor, Shuttle Processing, Program Integration, and S&MA. At the conclusion of this review, a certification statement is signed to attest to readiness of the ET to be delivered to the launch site for flight processing.

Prior Mission Performance – Review of available data from the previous mission in the following disciplines will be made to assure current processes/procedures are adequate to support the current mission:

a. OMRSD/LCC

b. Instrumentation

c. Main Propulsion System (MPS)

d. Hazardous gas

e. Test Preparation Sheet (TPS)

f. ET disposal

g. Orbiter tile damage

h. Post separation photos

Changes – All changes to the previous vehicle as–built/as–flown configuration in the following areas, for which the current mission is the first effectivity, will be presented:

a. Configuration

b. Requirements

c. Documentation

d. Manufacturing/processing

e. Tooling

Exceptions/Waivers – Identify any departures from specification and drawings and assure appropriate disposition of waivers, deviations or exceptions to program requirements has been obtained by project or program signature, as applicable for the following:

a. Program Requirements Waivers/Exceptions

b. Project Deviation Approval Requests (DARs)

Processing Anomalies – Any out–of–family occurrence, unique to or peculiar to the baselined methods of processing hardware that initiate either of the following documents/actions will be presented:

a. Out–of–family Senior Management Review (SMR)

b. Out–of–family Non–Conformance Document (NCD)

Baseline End Item Configuration – A comparison of the as–designed to the as–built end item configuration will include the following for presentation:

a. Satisfactory completion of a Configuration Inspection (CI)

b. First effectivity Class I changes

c. Class II changes

d. Comparison to End Item Specification (EIS) and ICD

Acceptance Checkout – Completion of Acceptance Checkout Requirements (MMC–ET–TM04k), including resolution of checkout discrepancies and any required associated retesting, will be documented and resolved by the appropriate Non–Conformance Document (NCD)

Ship–Loose Hardware – In preparation for shipment of the subject ET to the launch site, all shipping support hardware and uninstalled flight hardware will be statused and presented as follows:

a. Inspection of ship–loose hardware, status

b. Completeness of ship–loose hardware, Defense Contract Administration Service (DCAS) signature

c. Identification of ship–short items

d. Comparison to authorized planned work baseline

Planned Work/Mod Kits – Identification of all mission specific installations and/or assemblies and authorized modification kits scheduled for initiation/completion at the launch site will be presented to include the following:

a. Status with KSC/Shuttle Processing Contractor (SPC)/LSS interface

b. Discuss all planned work

c. Discuss all mod kits

d. Assure no open issues

Deferred Work – Identification of specific processing/manufacturing procedures normally performed/completed at MAF for which rationale is provided to justify performance and/or completion at the launch site for the subject effectivity:

a. Identify deferred work

b. Provide rationale for deferral

c. Obtain RMO approval

KSC Processing – A status of launch site vehicle processing activity with application to the subject mission in the following disciplines will be presented:

a. OMRSD Assessment/Exceptions/Waivers

b. Limited life hardware assessment

c. Mod kits, Discrepancy Check and Reports (DC&Rs), Building 45s, Field Engineering Changes (FECs)

d. Software status

Verification/Certification Status – As applied to this mission effectivity. A certification baseline status of program requirements revisions authorized since the previous mission will be presented to reflect the following:

a. Program certification baseline

b. Verification Status Report (MMC–ET–TM09)

c. Certificate of Qualification (COQ)/Hardware Certification Sheet (HCS) status for completeness

DR/PR/OMRSD Status – A count of discrepancy reports, problem reports and OMRSD changes associated with this mission effectivity will be compared to previous mission counts for trending purposes.

a. Significant OMRSD Changes/Exceptions/Waivers

b. DRs/PRs status/bean count

Loads/Thermal Assessment – Identification and assessment of mission profile unique integrated vehicle(preflight) and flight loads and thermal environments provided through analysis and/or instrumentation will be presented as follows:

a. Mission unique vehicle loads, status, issues

b. Thermal assessment–full body set, status, issues

S&MA Assessment – The Office of Safety and Mission Assurance will audit/monitor applicable disciplines of ET Project/contractor operations and will status their findings to include the following:

a. ALERTs

b. DC&Rs

c. MRBs

d. Hazards/CILs

e. Latent Defects/CAPs

f. Trending

3.0 SHUTTLE PROGRAM ET/SRB MATE READINESS REVIEW

The ET/SRB Mate Readiness Review will be presented to the SSP and will be conducted via telecon. The ET Project will support any out–of–family events which occur after the ET Hardware Acceptance and Readiness for Mate Review, and are considered to be a constraint to vehicle processing at the launch site.

4.0 ORBITER ROLLOUT/ET MATE READINESS REVIEW

The ET Project will support any out–of–family events which occur during launch processing post ET/SRB Mate Review, which are considered to be a constraint to vehicle processing at the launch site.

5.0 SSP FLIGHT READINESS REVIEW

The ET Project will support any out–of–family events occurring during launch processing post Orbiter Rollout/ET Mate Readiness Review.

6.0 PRELAUNCH MISSION MANAGEMENT TEAM REVIEW

The ET Project will support any out–of–family events occurring during launch processing post SSP Flight Readiness Review.

APPENDIX E

REUSABLE SOLID ROCKET MOTOR PROJECT
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX E

REUSABLE SOLID ROCKET MOTOR PROJECT FLIGHT PREPARATION PROCESS PLAN

PREFACE

The processes and procedures required to prepare a Reusable Solid Rocket Motor (RSRM) for flight are defined in NSTS 07700, Volume IV, Configuration Management Requirements; TWR–10150, Thiokol Configuration Management Plan; and Contract NAS–38100. These processes and procedures are performed under the cognizance of the RSRM Project Office with NASA approval being required on any changes. The Flight Preparation Process includes multiple Project Milestone Reviews. The purpose of the Project Milestone Reviews is to verify all the requirements have been satisfied and to ensure the as–designed, as–built, as–delivered RSRM configuration is ready for launch site processing and can be certified as flight worthy.

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APPENDIX E

REUSABLE SOLID ROCKET MOTOR PROJECT
FLIGHT PREPARATION PROCESS PLAN

1.0 RSRM ELEMENT ACCEPTANCE REVIEW

The RSRM Element Acceptance Review is a SSP review delegated to RSRM Project. This review certifies, based on audit, limited surveillance and out–of–family teaming, that the element has been manufactured according to specifications, and has been inspected and accepted by NASA, and further signifies the RSRM is ready to transfer from Thiokol to the launch site for flight processing. All out–of–family conditions discovered during the manufacturing process will be identified.

The RSRM Element Acceptance Review will be conducted by the RSRM Project and will be chaired by the RSRM Project Manager or designee. Review participants will include: RSRM Project, RSRM Chief Engineer, Thiokol, Shuttle Processing, JSC Space Shuttle Systems Integration, JSC Astronaut Office, S&MA, USBI, USA, and various MSFC labs as selected by the RSRM Program Manager. An agenda/presentation package will be formatted to include the topics delineated below. The review information presented and the order the topics are discussed will be at the discretion of the RSRM Project Manager.

Action items, when appropriate, will be assigned and documented with specific actionee(s) and the required closure date. Discussion of action items (open or closed) at the FRR CoFR will be at the discretion of the RSRM Project Manager.

The review will include the following information:

a. **Certification Status** – Review will include a status of all current constraints (personnel certification, waivers/deviations, etc.).

b. **Changes Since Previous Motor Set** – Review will include a summary of all changes since last motor set acceptance review (Class I hardware, critical process, noncritical process, OMRSD, etc.).

c. **Nonconformances** – Review will include all new nonconformances reviewed by the Senior Management Review Board (SMRB) which violate current engineering, any open nonconformances, and all nonconformances since last motor set.

d. **Waivers/Deviations Against Requirements** – Review will include a summary of all deviations/waivers.

e. **Quality and Reliability Assurance (Q&RA) Items** – Review will include a summary of Pre–Flight Assessment (PFA) review status, Problem Assessment System (PAS) actions, COQs, hazards, FMEA/CIL, and ALERTs.

f. **Hardware Configuration Inspection** – Review will include as–built vs. as–designed status, hardware status, hardware delivery status, limited life/time/cycle items, and hardware reuse summary.

g. **Technical Issues/Special Topics** – Review will include technical issues or special topics (e.g., special testing/analysis) which warrant discussion.

h. **Open Items/Exceptions** – Review will include any open items or exceptions which may impact launch operations.

i. **Readiness Assessment** – Review will include a statement that will certify that RSRM hardware is ready to support KSC stacking operations.

2.0 ET/SRB MATE MILESTONE REVIEW

The ET/SRB Mate Readiness Review will be presented to the Program Review Board. The RSRM Project will address any out–of–family events which occur after the RSRM Element Acceptance Review and are considered to be a constraint to vehicle processing at the launch site.

3.0 RSRM PROJECT PREFLIGHT READINESS REVIEW (PRE–FRR)

In preparation for the SSP FRR the RSRM Project will conduct a Pre–FRR to ensure their project FPPP has been satisfied. The RSRM Pre–FRR will be conducted by the RSRM Project and will be chaired by the RSRM Project Manager or designee. Review participants will include: RSRM Project, RSRM Chief Engineer, Thiokol, Shuttle Processing, JSC Space Shuttle Systems Integration, JSC Astronaut Office, S&MA, USBI, USA, and various MSFC labs as selected by the RSRM Project Manager. An agenda/presentation package will be formatted to include the topics delineated below. The review information presented and the order the topics are discussed will be at the discretion of the RSRM Project Manager.

Action items, when appropriate, will be assigned and documented with specific actionee(s) and the required closure date. Discussion of action items (open or closed) at the FRR CoFR will be at the discretion of the RSRM Project Manager.

In addition to all items addressed at the acceptance review, the Pre–FRR Review will include:

a. **Previous Flight Assessment** – Review will include a performance summary and a disassembly evaluation summary.

b. **Current Flight Predictions** – Review will include performance predictions, case buckling constraints and contingency wind LCC limits, and contingency joint heater LCC temperatures.

c. **Hardware Configuration Status** – In addition to updating items addressed at the acceptance review, review will include assessment of hardware processing and stacking at KSC. (Discussion of any items will be addressed in the Technical Issues/Special Topics Section.)

d. **Readiness Assessment** – Review will include a statement that will certify RSRM hardware is ready to support KSC Launch Operations.

4.0 FLIGHT READINESS REVIEW (FRR)

The RSRM Project will address any out–of–family events that are identified after the ET/SRB Mate Milestone Review and are considered to be a constraint to vehicle processing at the launch site.

5.0 PRELAUNCH MISSION MANAGEMENT TEAM REVIEW

The RSRM Project will address any out–of–family events that are identified after the FRR and are considered to be a constraint to vehicle processing at the launch site.

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APPENDIX F

SOLID ROCKET BOOSTER FLIGHT PREPARATION PROCESS PLAN

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APPENDIX F

SOLID ROCKET BOOSTER FLIGHT PREPARATION PROCESS PLAN

1.0 PURPOSE

The purpose of this document is to baseline the processes and procedures as defined by the Solid Rocket Booster (SRB) Project to be accomplished, as a minimum, in order to assure the as–designed, as–built, as–delivered SRB configuration is ready for launch site processing and can be certified as flight worthy. This process certifies, based on audit, limited surveillance and out–of–family teaming, that the element has been manufactured according to specifications, and has been inspected and further signifies the SRB is certified for flight processing.

2.0 SRB PROJECT ELEMENT ACCEPTANCE MILESTONE REVIEW

The SRB Project Element Acceptance Milestone Review will be presented to the SRB Project Review Board. The SRB Project Review Board consists of the MSFC SRB TMR or designee, MSFC SRB Chief Engineer, NASA S&MA representatives, Shuttle Processing, Space Shuttle Systems Integration, various MSFC labs as selected by the SRB TMR, and SFOC.

The review presentation materials, resulting minutes, and any actions assigned all make up the official record and will be maintained by SFOC.

The result of this review will be certification that the transferred hardware is ready for KSC processing and launch. Only deltas from this review, open actions and out–of–family problems will be discussed at subsequent reviews.

The review will include the following information:

a. **Previous Post–Flight Assessment** – Review will include a performance summary and a discussion of IFAs and post–flight PRs.

b. **Changes Since Last Flight Set** – Review will include a summary of all Class I hardware changes, critical process changes, OMRSD changes, and LCC changes since last flight.

c. **Certification Status** – Review will include a summary of all open work and personnel certification.

d. **Nonconformances/Criticality 1/1R test failures/anomalies since last flight set** – Review will include open PRs, out–of–family events or issues, waivers/exceptions/deviations, and open GFE anomalies since last flight set.

e. **SR&QA Summary** – Review will include a summary of open Criticality 1/1R PAS items, open COQs, open ALERTs, mandatory hazards and FMEA/CIL and time/cycle/limited life restrictions.

f. **Configuration Summary** – Review will include as–built vs. as–designed status, hardware changeouts, hardware delivery status and SRB/RSRM compatibility assessment.

g. **Technical Issues/Special Topics** – Review will include technical issues, special topics or special testing/analyses which warrant discussion.

h. **Open Items/Exceptions** – Review will include any open items or exceptions which may impact launch operations.

i. **MSFC S&MA Assessment** – Review will include an assessment based on S&MA audit and surveillance findings.

j. **Readiness Assessment** – Review will include a statement that will certify SRB hardware is ready to support KSC launch operations.

3.0 ET/SRB MATE MILESTONE REVIEW

The SRB Project will be available, if required, to support any out–of–family events occurring prior to ET/SRB mate, and any issues KSC has requested assistance for resolution.

4.0 SRB PROJECT PREFLIGHT READINESS REVIEW (PRE–FRR)

The Pre–FRR Review will highlight those significant items/issues, open action items or significant out–of–family conditions which have occurred since the Element Acceptance Milestone Review. The Pre–FRR Review will be presented to the same board members as identified in Paragraph 2.0 of this plan.

5.0 FLIGHT READINESS REVIEW (FRR)

The SRB Project will be available, if required, to support any SRB specific out–of–family events or issues occurring during launch processing.

6.0 PRELAUNCH MISSION MANAGEMENT TEAM REVIEW

The SRB Project will be available, if required, to support any SRB specific out–of–family events or issues occurring since the FRR.

APPENDIX G

MISSION OPERATIONS
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX G

MISSION OPERATIONS
FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

MOD organizations and supporting contractors practice an aggressive management style for process control and integrity assurance in order to maintain a high quality of mission preparation and operational support. Each organization is required to maintain and periodically evaluate metric data to assess the health and integrity of their particular process in support of overall flight preparation. This data is reviewed with top MOD management on a regular basis. MOD is responsible for a wide variety of mission preparation activities and products, and at any one time many missions will be in various states of preparation. These activities and products are divided between government and contractor accountable functions that are respectively performed or produced by MOD Civil Servants and SFOC personnel. The Mission Integration and Schedules Management Office within MOD is charged with the responsibility of making sure that all MOD elements are working to the same set of program–approved mission requirements and schedules, and it provides the necessary integration across MOD elements. Standard procedures and mission preparation templates provide consistent and timely delivery of quality products, both among MOD elements and to the program. Requirements are delivered to the SFOC for the execution of contractor accountable functions, and MOD executes the necessary insight into the SFOC flight preparation processes to assure that requirements are being correctly fulfilled and that flight operations functions continue to be controlled and appropriately implemented.

1.1 PURPOSE

The purpose of this appendix is to describe the activities the Mission Operations Directorate performs to fulfill the government accountable flight preparation responsibilities listed in Paragraph 8.5.7.1. It identifies the mission–specific products that MOD develops in support of the Shuttle Program, and the process by which MOD assures that those products are correct and compliant with program requirements. The fulfillment of the prescribed responsibilities in accordance with the process described in this plan provides certification to the Shuttle Program that the MOD is ready for flight. In addition, the MOD is responsible for providing insight into the contractor accountable functions performed under the SFOC and documented in NSTS 08117, Appendix R and the appropriate product development plans identified in NSTS 08117, Appendix R.

1.2 SCOPE

The FPP begins with the baselining of mission requirements by the PRCB and culminates with the MOD FRR. The scope of this document is limited to describing the processes required to fulfill MOD government accountable flight preparation requirements levied by Section 8.0. The details of the MOD FRR are described in the MOD FRR Plan: Mission Operations Directorate, Certification of Flight Readiness. The internal FPPs that are described in MOD documentation are summarized in this document. There are other documents that levy requirements on MOD and other program participants for flight preparation that are referenced here as applicable documents.

1.3 APPLICABLE DOCUMENTS

The following documents are referenced to provide further detail on the MOD FPP.

NSTS 07700, Volume VIII, Revision D, Operations. Refer to the following for additional information: Paragraphs 4.6.1, 4.6.2, 4.6.3, 4.6.4, and Appendices L, M, O, and P.

JSC 08969, Crew Procedures Management Plan (CPMP)

Memo DA8–87–173, Flight Rules Change Control Process, from Chief, Flight Director Office, August 26, 1987

MOD FRR Plan: Mission Operations Directorate, Procedure for Certification of Flight Readiness, latest version

JSC 22530, Flight Software Reconfiguration Performance Test Plan

RSOC86, Flight Operations Integration Group, Flight Techniques, and Flight Rules Documentation Procedures Handbook, March 7, 1987

RSOC86–0046E, Crew Training Catalog, Revision E, June 1, 1991

STSOC–TG–001230A, Flight Operations Support Personnel Training Guide Annex, Flight Controller Training Objectives, January, 1995

2.0 JSC MISSION OPERATIONS DIRECTORATE FLIGHT PREPARATION PROCESS

2.1 FLIGHT RULES

The STS operational flight rules and flight–specific annexes are defined, reviewed, approved, and released for flight.

Flight rules provide pre–defined guidance for making operational decisions in specific mission situations. Requirements for the generation of flight rules may be established by any program participant. The SSP has delegated the responsibility and authority to develop, maintain, and configuration manage the STS operational flight rules to the JSC Mission Operations Directorate. This includes the definition of rule technical content and rationale, dissemination for review, resolution of issues, baselining and change control, and publication of PRCB–approved generic and mission–specific flight rules documents. The program chartered Ascent, Orbit, and Entry Flight Techniques Panels (FTPs) provide forums for the technical development of mission operations procedures and techniques, and for the definition of any related flight rules required for enforcement. These panels also provide the forums for review of proposed flight rules and resolution of technical issues among program participants. All significant differences from previous flights are reviewed by the FTPs, the Payload Operations Working Group, or other appropriate operations forums, and where required are documented in new flight rules. Applicable flight rules are developed and reviewed with the appropriate Shuttle customer representatives during Payload Operations Working Group meetings and the Flight Operations Review. Customer representatives certify that they have reviewed all applicable flight rules as part of the FRR process. This certification is reviewed by MOD personnel at the MOD FRR. The proper MOD discipline ensures that all flight rules that are used to determine operational criticality or which furnish operational controls for CIL items are properly verified and annotated in the flight rules.

The Flight Rules Control Board (FRCB), chartered by the program and delegated to MOD, provides a structured process for the management of the flight rules, including formal review, change coordination and approval, configuration management, and publication and dissemination of the flight rules documents. The FTPs and the FRCB ensure that the flight rules meet program and mission requirements. The STS Operational flight rules and the flight–specific annexes are brought forward to the PRCB for formal program review and approval.

Input: Mission requirements; vehicle capabilities and constraints; flight rules requirements.

Output: NSTS 12820, Space Shuttle Operational Flight Rules, All Flights, Volumes I and II;
NSTS 18308, Space Shuttle Operational Flight Rules, Annex.

2.2 FLIGHT DATA FILE

The government accountable FDF is generated and controlled as specified in JSC 08969, Crew Procedures Management Plan (CPMP), and is certified as ready for flight.

The FDF is the set of documentation and related aids necessary for crew training and flight execution. The program has delegated the authority to MOD for definition, development, validation, and control of all crew procedures, flight plans, and related mission support documentation contained in the FDF. In turn, portions of the FDF are developed by the SFOC. Each flight has its own specific FDF documentation and hardware requirements. Engineering drawings are used along with the FDF manifest, and instructions and standards specified in JSC 08969, to define and document the FDF for each mission. Requirements for FDF content, especially crew procedures, may be generated by any program participant and approved requirements are transformed by various MOD organizations into the requisite FDF articles, and validated by desk–top audit, in integrated simulations, standalone training, or other analysis. An MOD OPR is assigned the responsibility and accountability for each government accountable article contained in the FDF. The Ascent, Orbit, and Entry FTPs provide a technical forum for any necessary review and coordination of crew procedure definition or the development of other FDF items.

All significant differences from previous flights are reviewed by the FTPs, the Payload Operations Working Group, or other appropriate operations forums, and where required are documented in new procedures or other FDF articles. Applicable sections of the SSP–produced FDF are developed and reviewed with appropriate Shuttle customer representatives during Payload Operations Working Group meetings and the Flight Operations Review. Customer representatives certify that they have reviewed all applicable sections of the FDF as part of the FRR process. In addition, customer representatives certify that all payload–produced payload FDF articles have been validated and are consistent with JSC 08969, Appendix F, Space Shuttle Flight Data File Preparation Standards or equivalent. These certifications are reviewed by MOD personnel at the MOD FRR. The proper MOD discipline assures that all crew procedures which are used to determine operational criticality or which furnish operational controls for CIL items are properly verified and annotated in the appropriate FDF document. The Crew Procedures Control Board (CPCB), chartered by the program and delegated to MOD, is responsible for the definition, development, configuration management, validation and publication of the total FDF. The CPCB executes this authority and responsibility as specified in JSC 08969.

Input: Mission requirements; FDF requirements.

Output: Validated government accountable FDF.

2.3 TEAM CERTIFICATION

The NASA Mission Control Center (MCC) flight control team members are certified for flight and the integrated NASA/contractor MCC flight control and support teams involved in direct mission execution are flight ready.

The FCT is an integrated team composed of MOD and SFOC personnel. Training consists of the structured execution of specific training objectives to provide the flight crew, the FCT, and MCC support personnel the necessary skills, mutual trust, and confidence in their ability to execute the Shuttle mission. Certification is the statement that personnel have met the criteria defined to assure that they are properly trained and can successfully perform their assigned mission responsibility. Integrated simulation FCT training is performed by SFOC personnel and consists of a training flow and associated training objectives specified for each discipline in the appropriate training guide. Standalone, generic, and mission–specific simulations are structured to satisfy these specific training objectives for each flight control discipline. The remaining certification training requirements (e.g., workbooks and reading, task lists, standalone training, etc.) are executed under government control. Certification occurs after a pre–defined level of training has been attained. The FCT members are evaluated by their management, the simulation team, and the Flight Directors to determine when they are certified, and appropriate certification records are maintained. MCC support personnel undergo an SFOC training and certification process tailored to meet the needs of the particular support area and their certification status is reported to MOD. MOD and SFOC jointly provide range safety training to each commander and pilot in accordance with requirements to assume responsibility as agents for the 45th Space Wing Commander to assure public safety during second–stage powered flight. It consists of a crew range safety orientation and briefing by Eastern Range personnel, and a flight specific simulation case to exercise flight crew and Flight Control Team range safety responsibilities, flight rules, and procedures. Prior to the FRR for each mission, a review of the roles and responsibilities of the flight crew, MCC Flight Control Team, and Range Safety personnel is conducted to complete the Range Safety Flight readiness process.

Customer representatives certify that all payload personnel supporting realtime operations have completed applicable training and/or certification programs and are prepared to support realtime operations in accordance with applicable joint operations interface procedures and flight rules. Customer representatives also certify that payload personnel with ground command responsibility are aware of the function, utilization and constraints associated with all of the commands in their inventory. Finally, customer representatives certify that all customer–provided payload training for the flight crew and flight controllers has been successfully completed in accordance with the agreements described in the PIP. These certifications are reviewed by MOD personnel at the MOD FRR.

Input:	FCT certification guides; mission–specific requirements.

Output:	Certified government accountable FCT.

2.4 FACILITY READINESS

All MOD facilities required for direct flight support as well as the network facilities are tested, verified, and certified.

All MOD facilities required for mission support including the MCC, ITF, SPF, and IPS, are evaluated to assure that all critical hardware and software is properly configured, and has been tested and verified according to mission–specific requirements that have been delivered to the contractor for implementation. MOD works closely with GSFC and the contractor to assure the readiness of the network to support the mission, and the network interfaces to the MCC are tested and verified prior to flight by performing a verification test with the Tracking and Data Relay Satellite System (TDRSS) prior to each flight. Customer representatives certify that all Payload Operations Control Center facilities and/or customer–provided GSE are ready for flight. This certification is reviewed by MOD personnel at the MOD FRR.

2.5 FLIGHT PLANNING AND MISSION RECONFIGURATION PRODUCTS

Program requirements for flight planning and mission reconfiguration products were delivered to the SFOC contractor for standard process execution.

2.5.1 Flight Planning Requirements

High level flight planning requirements for flight preparation activities are documented in the Flight Preparation Requirements Book (FPRB) that contains multi–flight and mission–specific requirements. These requirements are used to generate the more detailed requirements contained in the Flight Initialization Data Pack (FIDP) that both MOD and contractor elements implement in their flight preparation processes. The MOD Mission Integration and Schedules Management Office maintains configuration control of these requirements so that all elements, both government and contractor, are working to the set of program–approved mission requirements and schedules. MOD Resident Offices and the appropriate contractor elements are responsible for making inputs to these documents.

Input : Program requirements; Flight Preparation Requirements Book.

Output: Mission requirements for contractor implementation.

2.5.2 Flight Software Reconfiguration Process

MOD is responsible for facilitating development of the Build Specification requirements and ensuring accuracy of the Mass Memory content through insight of the configuration managed build and verification processes. The MMU load is the reconfigured flight–specific software which is used by facilities for training and verification, and loaded onto the Orbiter MMUs (hardware) for flight. The Mass Memory is built by the reconfiguration contractors using the requirements baselined in the Vehicle Cargo Systems/MMU Build Specification. Inputs to the Build Specification requirements (PASS and BFS OI software base, PASS and BFS Post CI patch/source changes, SM/Payload/Vehicle data, I–load Design, KSC TCS Sequences, and other software elements) are provided from many sources, and all Shuttle onboard software and data requirements are approved by the SASCB prior to processing. The reconfiguration process is highly automated and the tools used are tested and certified to high quality standards, and data integrity and consistency are assured during the entire process. The MMU load, once built, is then authorized for facility use by the SASCB and for flight at L–3.

Input: PASS and BFS requirements; approved FSW and data CRs.

Output: Flight–specific MMU load.

2.6 LAUNCH COMMIT CRITERIA MEL/MIL

The LCC Minimum Equipment List (MEL) and Mandatory Instrumentation Lists (MILs) are verified as complete and accurate.

NSTS 16007, Shuttle Launch Commit Criteria and Background Document, Appendix H, contains the MEL. A portion of that list is designated as flight–specific, and is developed by MOD prior to each mission. The flight–specific section is handled as a required LCC change for each flight. The MOD Systems Division prepares preliminary inputs for each mission by discipline. The inputs are determined based on all available sources that reference pertinent mission–related requirements information. The preliminary MEL input is submitted into the Flight Operations Review (FOR) process for review along with other FDF documents. Following disposition of any discrepancies, a preliminary LCN is prepared by the Systems Division and submitted into the LCC system where it is reviewed and approved in the same manner as other LCC change traffic. The final product out of this process is an approved LCN for NSTS 16007, Appendix H, Minimum Equipment List. A similar process is followed to define updates to NSTS 16007, Appendix I, Mandatory Instrumentation Lists. However, the MIL does not necessarily change from mission to mission, and consequently is updated on as–needed basis.

Input: Mission requirements.

Output: Approved LCN for NSTS 16007, Appendix H; approved LCN for NSTS 16007, Appendix I.

2.7 CONTRACTOR PROCESS INSIGHT

Process insight of contractor accountable flight preparation processes has detected no problems that impact flight readiness.

MOD insight of contractor accountable flight preparation processes is performed to assure that problems which impact flight readiness or operations do not go undetected. Surveillance is performed to assure that requirements are being correctly fulfilled and to provide validation that flight operations functions continue to be controlled and appropriately implemented. Insight is also accomplished through the flight readiness review process and review or independent assessment of out–of–family anomalies occurring in any phase of the program. Any out–of–family occurrences discovered by the contractor in their mission preparation are brought forward to MOD for review and concurrence. The SFOC requires that the contractor develop, implement, and maintain a Flight Operations Process Integrity Plan to define the health and stability of the processes and facilities that support MOD. Statements describing the service required of the contractor, the standard and expectation, and the maximum error rate are specified in the contract and documented in this plan. Metrics for all work involved in the flight operations processes including operations integration, training, certification, flight design, flight planning, flight crew support, facilities, flight control, and others as agreed to are delivered to MOD on a periodic basis. Objective evaluation criteria are used to assess the health and stability of the processes, as well as the delivered product quality, by MOD in executing this insight role.

2.8 MOD FLIGHT READINESS REVIEW

An MOD FRR is successfully completed when the processes and products required for flight are reviewed and are certified for flight.

Prior to the program FRR, MOD holds an internal FRR in which MOD organizations and support contractors participate. The procedure and content of the MOD FRR is specified in an MOD FRR Plan: Mission Operations Directorate, Procedure for Certification of Flight Readiness, latest revision. The MOD FRR is designed to meet, as a minimum, the CoFR requirements specified in Section 8.0 and results in MOD certifying that it is ready for flight. The Mission Operations Director chairs the review, which is attended by each MOD Division or Office Chief and by contractor management and conducted according to a standard format. Both government and contractor accountable functions are reviewed. MOD is responsible for implementing government accountable functions, and is responsible for generating requirements for and maintaining insight into contractor accountable functions. The contractor is responsible for implementing contractor accountable functions to fulfill NASA requirements. Sufficient data is presented by each responsible area to demonstrate that the requirements stated in the MOD FRR Plan have been met. This includes, but is not limited to, closure of previous action items for this mission, discussion of significant changes since last flight, discussion of any operational workarounds, and status of open work (both standard and non–standard) and closure plans. Exceptions, DRs, waivers, and open issues are reviewed for closure or resolution. IFAs (including vehicle, MOD facility, network, and payload anomalies) open from previous missions are reviewed for impact. Items that cannot be closed or resolved are clearly identified to be taken forward for discussion at the program FRR. As part of the review of MOD flight readiness, the GSFC Network Manager participates in the MOD FRR and attests that the integrated networks are tested, verified, and ready to support the flight. A signed statement from the GSFC

Mission Operations and Data Systems Directorate certifying the integrated network readiness is presented at the MOD FRR. Certification of flight readiness statements for all primary and secondary payloads manifested on a flight are obtained by the Space Shuttle Customer and Flight Integration Office and provided to the program/projects as necessary for review. Operational elements of these customer statements are reviewed to ascertain the readiness of payload–provided operations products, facilities, and personnel, and this assessment is presented at the MOD FRR. Also included in the MOD FRR is a review of the readiness of the Spacecraft Meteorology Group to support the flight. The status of their support plan, hardware and software, and forecaster certification is presented. The completion of the MOD FRR results in each designated responsible area signing the appropriate MOD Flight Readiness Statement(s) that are maintained on file.

Input: MOD FRR Plan: Mission Operations Directorate, Procedure for Certification of Flight Readiness, latest revision.

Output: MOD signed CoFR.

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APPENDIX H

SHUTTLE PROCESSING FLIGHT PREPARATION PROCESS PLAN

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NSTS 08117

FIGURES

NSTS 08117

APPENDIX H

SHUTTLE PROCESSING
FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

NASA Shuttle Processing will assess contractor performance for operations through insight, using audit, surveillance and other appropriate tools.

Any significant changes to processes require NASA approval. This approval is normally acquired through a change to a NASA approved critical Standard Practice Instruction (SPI).

NASA will retain management of the following activities:

a. Launch Countdown

b. Landing Sites

c. NASA Personnel Training

d. Project Reviews

e. Oversight of Critical Processes

Based on the operations insight and NASA retained management functions, the Director of Shuttle processing will certify flight readiness.

1.1 PURPOSE

This appendix describes the program level requirements and plan the NASA KSC Shuttle Processing Management Team implements and verifies prior to signing the CoFR.

1.2 SCOPE

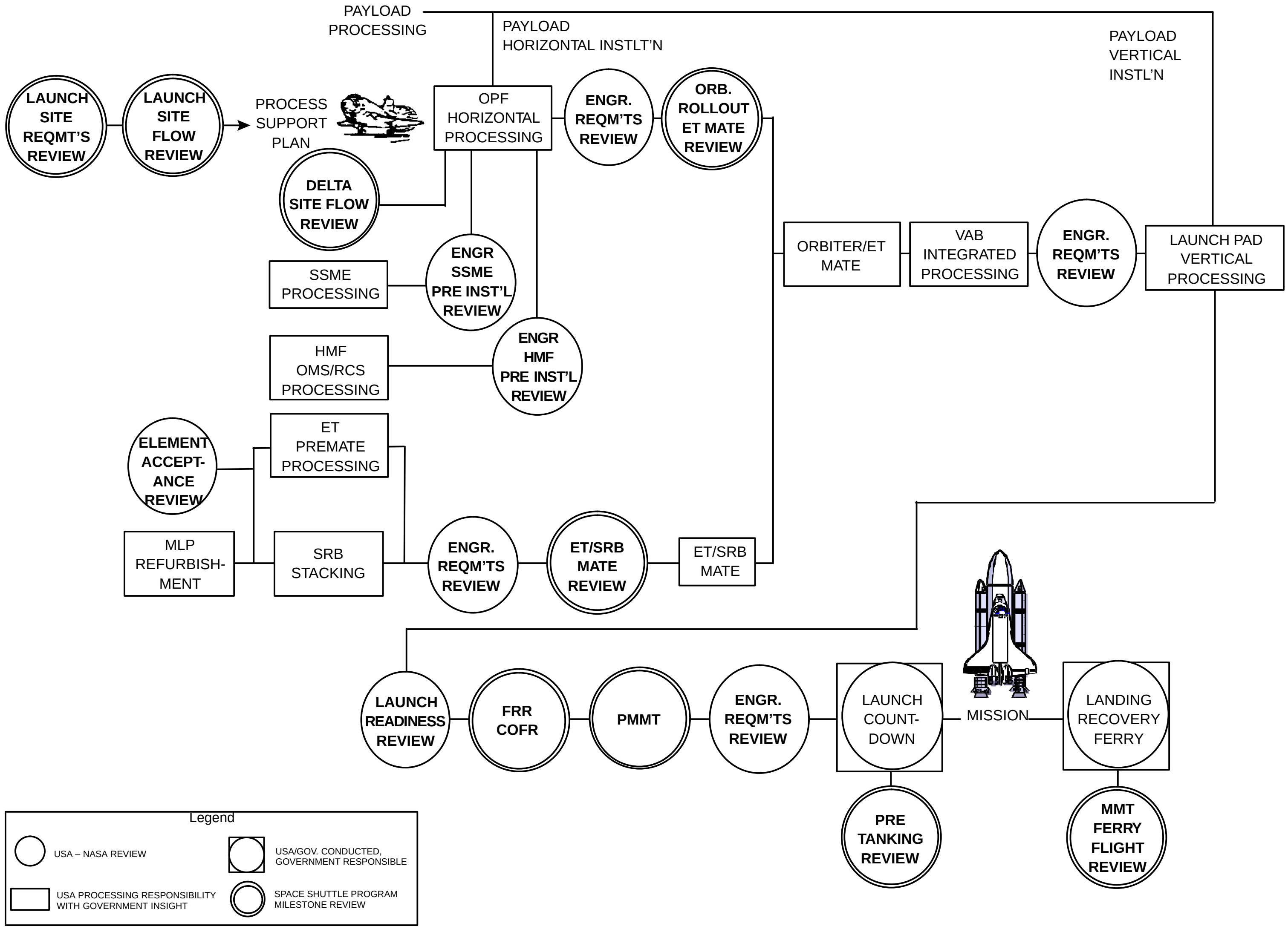
This document describes the summary level implementation plan of NASA managed activities and surveillance of SFOC ground operations processes.

The detailed Flight Preparation Process Plan is described in KPD 8630.3, KSC Shuttle Processing Flight Readiness/Certification Review Plan (current revision). It describes the NASA approved processes and planned surveillance activities of the contractor’s ground operations core processes to be performed prior to the NASA KSC Director of Shuttle Processing signing the CoFR endorsement.

Figure H–1 is a Shuttle processing flow plan outlining the many functions performed between Orbiter landing and launch. It is intended for the document to identify each supporting NASA organization’s roles and responsibilities in order for Shuttle Processing to provide an integrated assessment and endorsement of flight readiness. Each organization will establish and implement appropriate internal processes and reviews supporting their roles and responsibilities.

FIGURE H–1

SPACE SHUTTLE MILESTONE REVIEW PROCESS



2.0 ELEMENT PROCESSING

Shuttle processing at KSC, for a given mission, begins with a Launch Site Requirements Review and Cargo Integration Review followed by a Launch Site Flow Review. The requirements approved at these reviews are documented in an OMP which is used to develop a Process Support Plan (PSP) that outlines in detail all work to be performed at KSC for a specific mission. Any deviations from the OMP require approval by NASA. Each major element, i.e. Orbiter, SRB, ET, and SSMEs are then assembled and checked out individually prior to installation or mating for flight. Engineering Requirements Reviews are held prior to each major milestone to identify and resolve any constraints to ET/SRB mate and Orbiter Rollout for ET/Orbiter mate.

3.0 INTEGRATED PROCESSING

After the major elements are installed/mated, vertical integrated processing begins. Another formal Engineering Requirements Review and KSC Launch Readiness Review is held in preparation for the Flight Readiness Review and CoFR signing. All element and integrated processing is assessed by the Shuttle management team using audit, surveillance, and other insight tools.

4.0 RESPONSIBILITIES

NASA KSC Shuttle Processing Directorate is responsible for conducting NASA managed activities and providing surveillance of SFOC's ground operations processes. All issues or concerns are presented at appropriate milestone reviews and at the Launch Readiness Review (LRR)/FRR for flight readiness disposition.

4.1 NASA RETAINED ACTIVITIES

NASA KSC Director of Shuttle Processing will be responsible for the following NASA managed activities conducted by members of the KSC Shuttle management team:

4.1.1 Launch Countdown

Verifying all LCC defined for this mission are implemented, and all procedures, plans and schedules are in place to conduct launch countdown. Conduct launch countdown under the direction of the Launch team.

LCC changes are established via LCNs and approval is documented by SSP PRCBDs. All approved LCC directives are incrementally tracked from receipt through implementation and closure. This process is defined in a NASA approved critical SPI.

NASA KSC manages the development of plans and procedures controlled by OMI S0007 for launch countdown.

4.1.2 Landing Sites

Verifying that landing sites are properly configured and landing site personnel are properly trained and ready to be deployed. Conduct landing operations under the direction of the NASA landing team.

The landing sites are configured in accordance with requirements identified in the NSTS 07700, Volume X, Book 3, Space Shuttle Flight and Ground System Specification, Requirements for Runways and Navigation Aids, the SSP PRD, and the OMRSD. Equipment is maintained in accordance with the RMRS. Prelaunch testing is performed with approved TOPs and landing site personnel require training and certification.

NASA KSC manages the development of plans and procedures for landing.

4.1.3 NASA Personnel Training

Verifying that NASA L&L personnel actively participating in prelaunch checkout activities, and countdown and landing are trained, qualified and/or certified.

NASA certification requirements (classroom, On–the–Job Training [OJT] and standboarding) are established and enforced by each directorate. Certification status is tracked by the Directorate Training Coordinator.

4.1.4 Project Reviews

Satisfactorily completing a formal Shuttle Processing readiness review.

KSC conducts a LRR prior to the SSP FRR to ensure that SSP hardware, payloads, support equipment and processing facilities have been evaluated and assessed as defined in KPD 8630.3 (current revision).

4.1.4.1 Program Review Exceptions/Actions

Verifying that all exceptions listed from prior reviews, or actions from applicable readiness reviews, which constrain launch are identified and resolved.

Shuttle Processing originated exceptions (for FRR requirements) and action items assigned to Shuttle Processing at milestone reviews are identified and incrementally tracked in a Shuttle Operations Action Item system from identification through closure.

4.1.5 Oversight of Critical Processes

NASA KSC will retain oversight of critical processes such as disposition of “out–of–family” problems and management of development and upgrade activities. NASA KSC will specifically review and approve of the following:

4.1.5.1 OMRS Waivers/Exceptions

Assuring that all waivers, exceptions, and restricted hardware dispositions are acceptable for flight.

All flight, GSE and ground systems OMRSD noncompliances (waivers and exceptions) are reviewed for adequate rationale and for appropriate documentation. All OMRS exceptions, and OMRS waivers are forwarded to the SSP PRCB for approval. All flight and GSE restricted hardware use dispositions are reviewed by the PMRB. Configuration and CIL waivers are reviewed, dispositioned, and forwarded to the SSP PRCB.

4.1.5.2 Problem Disposition

Assure the disposition of the following:

a. NASA KSC will review a representative sample of all problem dispositions following closure. Out–of–family problem dispositions will be reviewed and approved prior to implementation.

b. Unexplained anomalies, IFAs, flight hardware and launch utilized facility, GSE and ground systems anomalies encountered during launch countdown, transferred to Shuttle Processing by the flight projects or encountered during prelaunch checkout and determined to be outside the experience base, are evaluated/reviewed and are dispositioned with remedial action or approved as acceptable for flight. Problems and remedial actions outside the experience base are subjects for additional review throughout the technical community.

4.1.5.3 Test/Configuration Requirements

Approving changes and implementation of the following:

a. The baseline of new requirements that dictate additions or modification to flight, GSE and facility hardware/software test/configuration requirements in the form of chits/Rocketdyne Action Requests (RARs) and RCNs are reviewed and approved by NASA.

b. The baseline of new requirements that dictate modifications to LPS ground software or to delivered flight software in the form of Orbiter Software Change Requests, DCRs, and Release Authorization Signature Sheets (RASSs) are reviewed and approved by NASA.

c. Unique first time implementation of flight, GSE and facility hardware/software test or configuration requirements levied on Shuttle Processing in the form of drawings, specifications, engineering orders, modification kits, technical orders, chits/RARs, and RCNs will be performed per NASA approved TOPs.

4.2 SURVEILLANCE OF SFOC GROUND OPERATIONS AND INTEGRATED LOGISTICS PROCESSES

NASA KSC is responsible for conducting surveillance of the SFOC's processes. An integrated assessment will be developed to support the CoFR endorsement for each mission. The specific requirements the contractor must satisfy are defined in Appendix R.

4.2.1 Requirements Control

Identify approved program and project element flight and ground requirements for implementation by Ground Operations.

Shuttle Processing will assess the SFOC's requirements control process to assure it is providing closed–loop accountability for implementation and closure of all flight, GSE and ground systems, hardware and software requirements.

Specifically, Shuttle Processing will address the anomaly resolution process, constraints management process, OMRS accounting, material review board process, configuration management, PRACA, hazard controls, CIL retention rational, and ALERT systems.

4.2.2 Planning and Scheduling

Integrate all requirements for the creation, review, validation, and publication of flight element schedules that place demands upon resources.

NASA will assess the SFOC's planning and scheduling process to assure it is capable to plan, coordinate, schedule and track closure of all open work that constrains flight readiness.

4.2.3 Work Instruction

Create flight element processing work instructions to approved requirements and processing discrepancies.

Shuttle Processing will assess SFOC's work instruction preparation process to assure it is technically correct, meets applicable SPIs and is capable of incorporating all flight hardware/software/GSE configuration and testing requirements which are identified to Shuttle Processing by the flight/facility design requirements.

4.2.4 Logistics

Execute interrelated processes to provide parts, material, and contracted services to launch site operations (excludes requirements definition).

Shuttle Processing will assess the SFOC's logistics process as defined in Appendix H, Attachment 1.

4.2.5 Facility and Support Equipment

Maintain certified, calibrated, and validated support equipment required to execute processing tasks (excluding LPS). Maintain and upgrade SPC–assigned facilities in safe operating order.

NASA will assess SFOC's facility and support equipment provisioning process to assure all issues associated with maintenance and certification are addressed prior to the establishment of flight readiness.

NASA will assess, through surveillance, the ground support equipment maintenance process, sustaining engineering, requirements control, procedural development, certifications, validations and task execution processes.

4.2.6 Task Execution

Implement flight element processing requirements.

Shuttle Processing will assess, through surveillance, the contractor's implementation of flight processing requirements including, but not limited to:

Assessments of first time quality, FOD programs, tool control and work area procedures.

4.2.7 Surveillance

Assess the health of launch site operations from an independent contract compliance, quality, and safety perspective (excludes self–audits).

Shuttle Processing S&MA will assess the SFOC safety and reliability processes to identify and mitigate the risks associated with facility and ground systems hazards and CILs. In addition, they will assess the SFOC quality processes and measures to ensure the adequacy and stability of processes.

4.2.8 Personnel Training

Identify, develop, and deliver technical training to support launch site operations. Includes standboards, proficiency boards, distance learning, and OJT.

Shuttle Processing will assess the SFOC's process of providing training and the capability of this training to qualify personnel to conduct Shuttle Processing operations.

4.2.9 (Deleted)

APPENDIX H, ATTACHMENT 1

SHUTTLE LOGISTICS
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX H, ATTACHMENT 1

SHUTTLE LOGISTICS
FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this plan is to define the KSC Shuttle logistics portion of the SSP Certificate of Flight Readiness process. This plan describes requirements satisfied by the NASA Shuttle Processing Directorate and their associated contractors. It identifies logistics activities accomplished, as a minimum, to assure the delivered hardware is ready for Shuttle/Payload processing.

1.2 SCOPE

The Shuttle logistics FPP consists of required products and services for a Space Shuttle mission, from KSC's acceptance of materials and hardware, to final delivery for installation or use by KSC operating elements. This includes but is not limited to repairs, off–line modifications, procurements, warehousing and failure analysis. The Shuttle Processing Directorate participates in program and project milestone reviews in support of Shuttle logistics. Major reviews include the LSFR, ET/SRB Mate Review, Orbiter Rollout Review, FRR, KSC Launch Readiness Review, and Ferry Flight Readiness Review.

2.0 RESPONSIBILITIES

The Shuttle Processing Directorate will implement the Shuttle logistics FPP responsibilities through audit, surveillance and inspection of the contractors' processes.

2.1 NONCONFORMANCES

2.1.1 Waivers, Deviations, Exceptions

Shuttle logistics will assure waivers, deviations and exceptions are closed and/or resolved through the element project with technical accountability. The contractors will deliver most flight hardware with complete data packages. On rare occasions when delivery is urgent, an item will be shipped with open hardware or paper issues. These discrepancies will be closed by the Design/Development Project prior to FRR or PMMT Review, and will be reported at the FRR subsequent to shipment.

2.1.2 Anomalies

Unexplained anomalies which occur during Shuttle logistics processing of hardware require a waiver prior to delivery. For unexplained anomalies which require the removal of suspect hardware, Shuttle logistics will provide the status of Test, Teardown and Evaluation (TT&E) or special troubleshooting activities to the Shuttle Processing element for use at the FRR or PMMT Reviews. If required, Shuttle logistics will report directly to the FRR Board or MMT. Status of anomalous hardware in the TT&E/failure analysis process is reported to the Design Element Project Office for problem closeout prior to the FRR, or for risk analysis and FRR Board acceptance or MMT acceptance post–FRR.

2.2 LOGISTICS SUPPORT

2.2.1 Intermediate/Depot Level Maintenance Items

All off–line hardware repairs, modifications, and replacements for which Shuttle logistics has authority and responsibility are accomplished to design element requirements. Any violation of the intended specified use will require a waiver from the appropriate authority.

2.2.2 Logistics Support Service

Support service activities include, but are not limited to: component cleaning, sampling and analysis, standards and calibrations, intermediate shops, non–destructive evaluation labs, propellant management, life cycle management. The contractors are responsible for ensuring the end item requirements are satisfied.

2.2.3 Material Management

Material management activities include, but are not limited to: inventory, transportation, and warehousing. The contractors are responsible for ensuring all materials and hardware are properly handled, stored and maintained in compliance with procedures.

2.2.4 Launch Critical Spares

The availability of priority/critical spares is assured by a spares reservation policy. The goal is to ensure that functional priority spares are maintained in ready for use condition and reserved in the Inventory Management System to support critical applications. The contractors are responsible for reporting the status of priority spares as a part of the applicable pre–test and pre–operational readiness review and FRR.

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APPENDIX J

ISS/PAYLOADS PROCESSING
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX J

ISS/PAYLOADS PROCESSING FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

1.1 PURPOSE

The ISS/Payloads Processing Flight Preparation Process Plan defines the KSC Payload Processing portion of the SSP CoFR process. This plan describes the requirements satisfied by the NASA ISS/Payloads Processing Directorate, its Payload Ground Operations Contractor (PGOC), and personnel involved in the conduct of payload processing. It identifies the products and/or methods of requirements satisfaction, which when completed, certifies that all payloads are ready for launch and flight operations.

1.2 SCOPE

The certification of the FPP consists of the required products and preparations for a Space Shuttle mission, from arrival or acceptance of payload hardware through integration, processing, launch, and deintegration when required. The major elements of the payload processing FPP are the activities discharged by the KSC Payload Mission Processing Team (MPT), the Payload Ground Operations Review (GOR) as applicable, the Payload Readiness Review (PRR), the Orbiter Rollout/ET Mate Milestone Review, the Launch Readiness Review (LRR), and the final CoFR endorsement signed in support of the FRR.

2.0 RESPONSIBILITIES

The MPT is comprised of NASA and contractor personnel (engineering, safety, communications, operations, etc.) and payload customer representatives responsible for the development of products and their implementation which ensure payload readiness for flight. The integrated requirements reviewed by the MPT in preparation for flight includes, but is not limited to the following activities:

2.1 ACTION ITEM REVIEW

All payload action items from previous reviews are resolved or closed.

All payload action items from the GOR, PRR, Orbiter Rollout/ET Mate Milestone Review, and LRR are tracked through completion via the minutes of those reviews.

Input: Previous GOR; PRR; Orbiter Rollout/ET Mate Milestone Review; LRR minutes.

Output: Satisfaction and completion of action items reported at next level review.

2.2 CONFIGURATION AND TEST REQUIREMENTS ASSESSMENT

All payload flight and ground installation, checkout, and limited life specifications and requirements are successfully maintained or completed in accordance with approved documentation.

Configuration requirements are provided to Payload Operations in: Payload Requirements Document (PRD); Operations and Maintenance Requirements and Specifications Document (OMRSD); drawings; Engineering Orders (EOs); Interface Control Documents (ICDs); modification kits; and Payload Integration Plans (PIPs). These requirements are incorporated into the approved Technical Operating Procedures (TOPs) and reviewed by engineering and quality assurance for adherence to the requirements. All time, life, and interval inspection requirements are tracked by engineering and quality assurance for adherence to requirements. OMRS requirements are closed–loop tracked via the Requirements Allocation Matrix (RAM). Drawing requirements are verified with comparisons of the Engineering Configuration List (ECL) and the As–Built Configuration List (ABCL). All exceptions and waivers to any requirement or specification are documented and approved by the PRCB. Open Item Status Report (OISR) reviews and formal constraint list reviews are routinely performed by engineering, quality assurance, and technicians to ensure requirements are met prior to the next milestone.

Input: OMRSD; Requirement Change Notices (RCNs); VS & VD drawings; ICDs; PIPs; ECL; Technical Orders; PRD.

Output: TOPs; Launch Site Support Plan (LSSP); Mission Unique Drawings (MUDs); OMRS RAM; Payload Integrated Control Schedule (PICS); OISR; ABCL; OR/OD; Electrical Connector Mate/De–mate Log.

2.3 DESIGN AND SPECIFICATION CHANGES

All payload significant differences from previous flights as identified by the responsible design agencies are reviewed and documented.

Significant payload differences are reviewed by Payload Operations engineering as part of the Preliminary Design Review (PDR), Critical Design Review (CDR), Cargo Integration Review (CIR) data packs and RCNs. The differences are assessed for operational impacts and documented in the appropriate TOP. In addition, realtime engineering changes that are implemented are documented in the applicable ABCL. Proper configuration is verified by comparison of the ECL and ABCL and by closure of the OMRS RAM and TOPs.

Input: ECL; PDR; CDR; CIR data packs; RCNs.

Output: ABCL; TOPs; OMRS RAM.

2.4 ANOMALY RESOLUTION/ASSESSMENT

All payload IFAs, as identified by the responsible design agency, are addressed and all changes and recurrence control actions identified are reviewed for operational procedure impacts and implemented per approved specifications.

All previous payload IFAs applicable to the next flight are identified to Payload Operations by the responsible design agency and assessed for operational impacts. Anomalies involving payload–to–Orbiter interfaces are documented and worked in an appropriate TOP or PRACA. PRACA resolutions are provided to the Design Center. Similarly, recurrence control and corrective actions identified by the Design Centers are implemented per approved documentation.

Input: IFAs.

Output: TOPs; PRACA.

All payload processing flight– and GSE–related hardware and software IPRs, PRs, Unexplained Anomalies (UAs), and other processing documentation are properly resolved, dispositioned, and approved.

KSC Payload Processing Engineering reviews each newly documented discrepancy and anomaly on a daily basis. Problems and remedial actions outside the experience base are subject to additional review throughout the technical community. While a majority of the problems are resolved by returning to print configuration, some problems are subject to the Material Review Board (MRB) and/or PRCB actions. All problems are documented in the PRACA System, dispositioned per NASA/PGOC Standard Practices and Procedures (SPP) documentation and are managed by the constraints system, which assures timely resolution. The constraints system provides an itemized OISR based on the identified constraint. The OISR is reviewed by engineers and quality assurance at appropriate points in the ground processing. Issues identified as a result of these reviews are discussed with the technical community and management for resolution and visibility. Significant resolutions and open problems are discussed at the GOR, PRR, Orbiter Rollout/ET Mate Milestone Review, LRR, and FRR.

Input: PRACA.

Output: PRACA Reports; Lessons Learned Report; OISR; PICS.

2.5 HARDWARE CERTIFICATION/VERIFICATION

All certification or verification requirements for payload processing as defined for this mission are satisfied.

Formal design reviews are held for each design modification to validate that change or modification requirements are being satisfied properly. RMRS and OMRS requiring testing and periodic maintenance are conducted for established GSE. Application software is updated as a result of requirement changes and modifications. Changes are impacted and managed via the SSP Payload Operations Software Control Board. Software certification and validation procedures are tracked as a part of this system.

Input: Data pack; Discrepancy Notices (DNs) and RIDs; RMRS; OMRS.

Output: TOPs; software updates.

2.6 LAUNCH COMMIT CRITERIA ASSESSMENT

Payload Launch Commit Criteria (LCC) are defined, reviewed, and concurred for flight.

The Payload Operations LCC Site Coordinator is the Payload Operations Representative to the LCC Working Group responsible for ensuring that all payload LCC Change Notices (LCNs) are reviewed by the appropriate NASA and PGOC system engineers and approved for flight. LCC monitor techniques are identified in the KSC document, KVE–PL–0007, which is updated each flow, if required. After LCN approval, LCC preplanned contingency procedures are incorporated in TOPs.

Input: Payload LCNs.

Output: Comments to LCNs; KVE–PL–0007 (as required); TOPs.

2.7 TECHNICAL OPERATING PROCEDURES ASSESSMENT

All payload TOPs issued for launch, landing, and contingency activities are approved and released. All remaining work is defined on an approved schedule.

SPPs establish the lead time that a procedure must be released prior to beginning work. Prior to release of a TOP, periodic reviews are held per established payload engineering templates. The MPS, PICS, and KICS determine the need dates for the TOPs. Deviations to the procedures are evaluated and incorporated per the appropriate SPP approval process.

Input: OMI Tracking System (OTS); SPPs.

Output: TOPs; processing plans and schedules (e.g., PICS, KICS, etc.).

2.8 PERSONNEL CERTIFICATION

Payload personnel actively participating in launch and landing sites are trained, certified, and ready to support the mission.

PGOC Certification Board, as identified in the Payload Operations Training Plan, determines and oversees the basic training policy of their personnel. Certification sheets, listing of all requirements by console position, are approved by this board. PGOC training records are reviewed and certification cards issued to those personnel that have met all the requirements. Technician certification requirements are controlled by the TOP.

NASA engineering certification requirements, classroom and On–the–Job Training (OJT), are identified in the Payload Operations Training Plan and enforced by the individual Payload Operations Divisions. Certification status is tracked by the Directorate Training Coordinator.

Each payload customer personnel organization is required to provide a description of their training and certification program to the KSC Safety Office as part of their launch site safety plan. This program description specifies the training requirements and certification procedures employed to establish acceptable skill levels for all payload customer personnel involved in the ground processing of their payload and its GSE.

Input: Contractor board; Payload Operations Training Plan.

Output: Training reports; certification cards.

2.9 LANDING SITE READINESS

The landing sites are properly configured to support payload operations and the landing site personnel are ready to be deployed.

For every mission, Payload Operations prepares a KSC Off–Site Operations Plan to ensure proper configuration of landing sites. This plan is developed from the requirements defined in the OMRS, the SSP PRD and from inputs obtained through technical interface meetings with the payload customers. Additionally, it includes a list of personnel, including alternates, required for rapid response and for second response. Technical requirements are verified and implemented via the TOPs. OMRS requirements are closed–loop tracked by the RAM. Required GSE and equipment is staged at the landing sites via the equipment lists contained in the TOPs. These items are verified operational by payload operations engineering and quality assurance. In addition to the KSC Off–Site Operations Plan an Early Access Runway Destow Plan is developed for KSC and Dryden Flight Research Center (DFRC). This plan provides specific details involving destow schedules, power and handling requirements, personnel, transportation and communications.

Input: OMRS; customer inputs; LSSP; SSP PRD.

Output: TOPs; Early Access Runway Destow Plan; KSC Off–Site Operations Plan.

2.10 ENGINEERING ASSESSMENT

An engineering assessment of applicable payload requirements for this review is complete.

Throughout payload processing, meetings with engineering and management are conducted to assess readiness to proceed to the next processing milestone. Engineering review of the OISR verifies that all required work has been completed. In addition, review of the OMRS RAM ensures that all applicable OMRS requirements have been completed/closed in support of the subject reviews.

Input: OISR; OMRS RAM; ABCL.

Output: Payload readiness statement; OISR; OMRS RAM updates.

2.11 PROJECT REVIEW

The payload project review is complete.

Prior to the FRR, a meeting is chaired by the Payload Flight Operations Director to status the completeness of all requirements (reference Section 8 of this document). Upon completion of this meeting a project level CoFR form is signed by the responsible NASA engineering, operations, and management representatives.

Input: Payload Processing Flight Preparation Plan.

Output: Project CoFR.

APPENDIX J, ATTACHMENT 1

ISS/PAYLOADS LOGISTICS
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX J, ATTACHMENT 1

ISS/PAYLOADS LOGISTICS
FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this plan is to define the KSC payload logistics portion of the SSP Certificate of Flight Readiness process. This plan describes requirements satisfied by the NASA ISS/Payloads Processing Directorate and their associated contractors. It identifies payload logistics activities accomplished, as a minimum, to assure the delivered hardware is ready for payload processing.

1.2 SCOPE

The ISS/Payloads logistics FPP consists of required products and services for Space Station and Space Shuttle, from KSC's acceptance of materials and hardware, to final delivery for installation or use by KSC operating elements. This includes but is not limited to repairs, off–line modifications, procurements, warehousing and failure analysis. The ISS/Payloads Processing Directorate participates in program and project milestone reviews in support of payload logistics. Major reviews include the Payload Readiness Review, FRR, and KSC Launch Readiness Review.

2.0 RESPONSIBILITIES

The NASA ISS/Payloads Processing Directorate will implement the payloads logistics FPP responsibilities through audit, surveillance and inspection of the contractors' processes.

2.1 NONCONFORMANCES

2.1.1 Waivers, Deviations, Exceptions

The Payloads Project will assure waivers, deviations and exceptions are closed and/or resolved through the element project with technical accountability. The contractors will deliver most payload hardware with complete data packages. On rare occasions when delivery is urgent, an item will be shipped with open hardware or paper issues. These discrepancies will be closed by the Design/Development Project prior to FRR or PMMT Review, and will be reported at the FRR subsequent to shipment.

2.1.2 Anomalies

Unexplained anomalies which occur during payload logistics processing of hardware require a waiver prior to delivery. For unexplained anomalies which require the removal of suspect hardware, payload logistics will provide the status of TT&E or special trouble-shooting activities to the payload processing element for use at the FRR or PMMT Reviews. Status of anomalous hardware in the TT&E/failure analysis process is reported to the Design Element Project Office for problem closeout prior to the FRR, or for risk analysis and FRR Board acceptance or MMT acceptance post–FRR.

2.2 LOGISTICS SUPPORT

2.2.1 Intermediate/Depot Level Maintenance Items

All off–line hardware repairs, modifications, and replacements for which payload logistics has authority and responsibility are accomplished to design element requirements. Any violation of the intended specified use will require a waiver from the appropriate authority.

2.2.2 Logistics Support Service

Support service activities include, but are not limited to: component cleaning, sampling and analysis, standards and calibrations, intermediate shops, non–destructive evaluation labs, propellant management, life cycle management. The contractors are responsible for ensuring the end item requirements are satisfied.

2.2.3 Material Management

Material management activities include, but are not limited to: inventory, transportation, and warehousing. The contractors are responsible for ensuring all materials and hardware are properly handled, stored and maintained in compliance with procedures.

2.2.4 Launch Critical Spares

The availability of priority/critical spares is assured by a spares reservation policy. The goal is to ensure that functional priority spares are maintained in ready for use condition and reserved in the Inventory Management System to support critical applications. The contractors are responsible for reporting the status of priority spares as a part of the applicable pre–test and pre–operational readiness review and FRR.

APPENDIX K

FLIGHT CREW OPERATIONS
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX K

FLIGHT CREW OPERATIONS
SPACE SHUTTLE FLIGHT PREPARATION PLAN

1.0 PURPOSE

The purpose of this document is to describe the process by which the Flight Crew Operations Directorate (FCOD) meets its responsibilities in preparation for Space Shuttle missions.

2.0 SCOPE

In addition to the preparation of flight crews for each upcoming mission, the FCOD provides support for a wide variety of mission preparation and on–going SSP activities. The scope of this Flight Preparation Plan is limited to those activities and support of program boards/panels which can be attributed to specific mission preparation. Activities of an on–going nature which cannot be identified with a specific mission are not described in this document.

3.0 FLIGHT CREW OPERATIONS FLIGHT READINESS REVIEW

Prior to each SSP FRR, the Director of FCOD conducts a FRR to ensure that activities and products described in Section 4 of this appendix have been completed, will be completed prior to launch, or that FCOD is prepared to provide the required support, as appropriate. The FRR is chaired by the Director, FCOD and includes participation by the Astronaut Office, Aircraft Operations Division, and Vehicle Integration Test Team Office. Additionally, the following organizations are invited to participate as observers:

a. Flight Director Office

b. News and Information Services Branch

c. Space Shuttle Customer and Flight Integration Office

After this review, two Statements of Flight Readiness are prepared and signed.

a. One statement which reads:

“ALL FLIGHT CREW MEMBERS HAVE SUCCESSFULLY COMPLETED REQUIRED TRAINING AND MEDICAL EXAMINATIONS.”

is signed by a representative from MOD, a representative from the Space and Life Sciences Directorate, the Chief of the Astronaut Office, and the Director of Flight Crew Operations.

b. Another statement which reads:

"ALL AIRCRAFT ARE CURRENT IN INSPECTION AND MAINTENANCE AND ALL FLIGHT CREW AND MAINTENANCE PERSONNEL HAVE COMPLETED CERTIFICATION AND ARE CURRENT."

is signed by the Chief of Aircraft Operations Division and the Director of Flight Crew Operations.

The Director, Flight Crew Operations supports both the JSC Center Director FRR and the SSP Flight Readiness Review and is a member of the SSP MMT.

4.0 FLIGHT PREPARATION ACTIVITIES

4.1 VEHICLE INTEGRATION TEST OFFICE (VITO)

The VITO supports the Launch Control Center Team during the Shuttle processing flow from landing through launch to ensure that FCOD's requirements are incorporated and validated. The integration of flight crew, vehicle, and crew equipment are accomplished by parallel review of the operational configuration, checkout, and acceptability of the Space Shuttle Orbiter systems and payloads. Approximately six weeks prior to launch, the VITO organizes the CEIT during which the crew verifies crew equipment interfaces and Orbiter equipment interfaces. During the launch count, the VITO monitors pre-launch activities and documents any discrepancies or anomalies involving crew interface. Discrepancies identified at any time during vehicle processing or launch count are resolved prior to launch.

4.2 ASTRONAUT OFFICE

The Astronaut Office assigns the flight crew for each Space Shuttle mission and ensures that each member of the crew is adequately trained and certified for flight. The flight crew Commander supports the Space Flight Training Division of MOD in developing a mission–specific training plan. The bulk of this training plan is based on the training syllabus in RSOC86–0046. MOD schedulers work jointly with Astronaut Office schedulers to schedule crew training and execute the training plan. Orbiter systems/operations training is provided by MOD. Payload training is provided by either MOD or the customer as required in the Payload Integration Plan (PIP). Approach and landing training in the Shuttle Training Aircraft (STA) is conducted by the Aircraft Operations Division (AOD). The Astronaut Office verifies that all required training is accomplished and reports the status of crew training to the Director at the FCOD FRR.

Although the Astronaut Office is responsible for verifying the physiological capability of the crew to execute the mission, the Medical Operations Branch of the Medical Science Division of the Space and Life Sciences Directorate conducts medical examinations and certifies that the crew is medically qualified for flight.

The Astronaut Office integrates any payload specialists and alternate payload specialists into the flight crew. This activity includes coordination with MOD for the accomplishment of required Orbiter training. The Astronaut Office also certifies the flight readiness of any payload specialists.

4.2.1 Astronaut Office Support of Mission Operations

The Astronaut Office assigns mission support personnel that are trained and certified for supporting the Mission Control and Launch Control Teams. These personnel include Capsule Communicators (CAPCOMs) and Astronaut Support Persons (ASPs).

The CAPCOMs are members of the FCT in the MCC and are responsible for all voice communication with the Space Shuttle. CAPCOMs are certified in accordance with the requirements delineated in the CAPCOM Handbook, Section VIII. A letter certifying that the CAPCOMs have completed the requirement training is forwarded to the Director, FCOD prior to each mission.

The ASPs support the Launch Control Team for launch and support the Landing/Recovery and FCTs for landing. The ASPs perform various actions in the crew cabin prelaunch and post–landing as directed by the Control Team, as well as assist the crew with ingress and egress. The ASPs receives OJT as well as training delineated in K–STSM–12.5.04, KSC Ground Operations Training Plan for Space Shuttle Operation. A letter certifying that the ASPs have completed the required training is forwarded from the Chief of the Astronaut Office to the Director of Quality Assurance, KSC prior to each mission.

The Astronaut Office assigns other mission support personnel as follows:

a. Support the Spacecraft Analysis Network (SPAN) Team. An astronaut is assigned to support SPAN for each day of the mission. The Astronaut SPAN Representative generally serves for a 24–hour period.

b. Astronaut pilots at the launch site and the primary and backup landing sites to perform weather reconnaissance in the STA. These are astronauts who have flown as Space Shuttle Commanders.

c. Pilots at the Transatlantic Abort Landing (TAL) sites for launch to perform weather reconnaissance in government provided aircraft. These pilots are either astronaut pilots who have completed the astronaut candidate training syllabus and have had STA training or staff pilots from the AOD.

d. One astronaut in the MCC to perform as the weather coordinator (called the Weather CAPCOM). This person serves as the Mission Control Team focal point for all weather information provided by pilots at the launch, landing, and TAL sites.

e. One astronaut in the Launch Control Center to perform as weather coordinator for information provided by the launch site weather reconnaissance aircraft.

f. Personnel to support the FCOD Contingency Action Centers for launch, orbit, and landing. These personnel are responsible for executing the FCOD Contingency Action Plan in the event of a contingency.

g. Personnel to support flight software testing the Shuttle Avionics Integration Laboratory (SAIL). These personnel are “on call” to support flight software evaluations should a situation develop that puts flight software in question.

h. Trained astronauts to be on standby to perform test and evaluation in the WETF, SMS, and other facilities as may be required to support flight operations decisions.

4.2.2 Astronaut Office Support of Mission Development

The Astronaut Office supports several board and panel activities in preparation for each mission as follows:

a. **Program Requirements Control Board (PRCB)** – The Astronaut Office provides the standing FCOD member of the PRCB. This is the SSP Manager’s board for approving/dispositioning all program level changes and issues for each mission including resolution of IFAs.

b. **Configuration Control Board (CCB)** – The Astronaut Office provides a representative to the CCB. This board dispositions all issues of Orbiter/payload configuration requirements to support each mission.

c. **Integration Control Board (ICB) and Integrated Product Teams (IPTs)** – Each Space Shuttle mission includes specific payloads, Detailed Supplementary Objectives (DSOs) and Detailed Test Objectives (DTOs). Early in the development of these elements of a mission, FCOD is involved in developing hardware, software, procedures, and safety requirements in order to fully integrate the mission in a way that optimizes crew time on–orbit while ensuring the success of the mission. DSOs and DTOs which are candidates for flights are thoroughly reviewed for technical adequacy and operational readiness. Changes to configuration or established documentation payloads, DSOs or DTOs are reviewed by the appropriate Astronaut Office representative or assigned flight crew, who disposition the CRs at the ICB or IPT.

d. **Scientific Merit Review Committee (SMRC)** – The SMRC is a board that looks at experiments which have been submitted to see if they look like they are good science. If approved by the SMRC, they then go to the JSC Institutional Review Board (IRB) then to NASA Headquarters for a formal peer review. A representative of the Astronaut Office is a member of the SMRC.

e. **JSC IRB, formerly the Human Resources Policies and Procedures Committee (HRPPC)** – There are many payloads and DSOs which use a human crew member as a test subject. Usually, Baseline Data Collection (BDC) is required preflight and post–flight in order to provide ground–based data which is compared with data taken in–flight. An Astronaut Office representative who is a medical doctor is a voting member of the IRB, which reviews all protocols and certifies that they are safe and within the realm of known medical practice. Each participating crew member also signs a consent form which gives the principal investigator permission to perform the BDC, training procedures, or whatever protocol has been approved by the IRB.

f. **Crew Procedures Control Board (CPCB)** – The CPCB is supported by the Astronaut Office FDF representative. This board meets bimonthly to consider changes to the onboard FDF and to the Crew Procedures Management Plan (including Appendix K, Crew Scheduling Constraints). Appendix K was developed as a constraints document for scheduling crew time on–orbit as well as during the post–flight time frame. The document was developed by FCOD, the flight surgeons, the timeliners, and the payload officers. Any violation of the constraints in this document must be submitted as a waiver to Appendix K, and must be approved by the CPCB. The Astronaut Office reviews all waivers for mission requirements, crew needs, science requirements and other considerations and is a voting member of the CPCB.

g. **Portable Onboard Computer Adjunct (POCA) to the CPCB** – The Astronaut Office provides a representative to the POCA. The POCA performs the following functions: Establishes and implements policies for coordinating Portable Onboard Computer (POC) software integration, manages overall POC flight software, defines configuration control requirements, establishes guidelines for software compatibility, determines level of validation required, identifies supported Commercial Off–the–Shelf (COTS) software, directs the development and maintenance of POC software utilities, defines POC software and interface standards, monitors POC software logistics activities, manages STS hard drive resources, coordinates POC hardware requirements, and manages STS flight–specific software configurations.

h. **Crew Equipment Boards** – The Astronaut Office's flight crew equipment requirements must be integrated with mission and program requirements. The

Astronaut Office provides management and engineering direction in the design of the flight crew equipment including new hardware, modifications/upgrades of existing hardware, open problems, documentation changes, and changes in the Crew Compartment Configuration Drawing (CCCD) for over 1,600 pieces of hardware for every mission. The Astronaut Office also has a voting member on various boards, reviews, technical design meetings, and tests, and participates in fit checks of the Launch and Entry Suit (LES) and clothing. Hardware requirements are reviewed at CEIT, Bench Review, and TCDT.

i. **EVA Support Equipment Review Panel (ESERP)** – The purpose of this review panel, of which FCOD is a member, is to provide a method of evaluating all EVA support equipment requirements. It also prioritizes the approval of those requirements for the EVA support equipment community. The panel approves, maintains control of, and dispositions all CRs for requirements and certification of all EVA tools and equipment.

j. FCOD is also involved in evaluations of potential EVA procedures and hardware, the design of new EVA tools and equipment, and protocols for future EVA missions. Various review meetings, technical design meetings and on–site reviews at contractor facilities are attended by FCOD personnel. Fit checks and actual operation of flight hardware is performed by assigned crew members.

k. FCOD also is a member of the EVA Assessment Team (EVAAT) which is chaired by MOD. This team is made up of all of the members in the EVA community and reviews the objectives, priority, timeline, procedures, etc., to make sure that everything has been considered before an EVA is performed.

l. **RMS Boards** – The Robotics and Integration Team provides oversight of all Astronaut Office activities in support of Space Shuttle robotics efforts on issues that affect flight crew operations. The RMS Flight Software Working Group coordinates the development of enhancements and corrections to Shuttle RMS flight software from the conceptual phase through final testing. The Change Request Working Group provides the sustaining engineering and CR development support for enhancements and corrections to Shuttle RMS flight software. The RMS Configuration Control Panel provides the oversight of all proposed changes to Shuttle RMS hardware, software and operational procedures and provides recommendations to the appropriate JSC control boards and support contractor organizations. Test Readiness Review boards provide oversight and approval for the use of hardware and software developed for use at training facilities to ensure their compliance to all requirements applicable to the facility.

Evaluation of hardware, software, and operational concepts are conducted periodically at various robotics simulators and laboratories to support both basic research and product development.

m. **Flight Techniques Panels** – The Ascent/Entry Flight Techniques Panel is supported by an ascent/entry CAPCOM. This panel meets monthly to develop techniques and flight rules used in ascent and entry flight phases. The Orbit Flight Techniques Panel is supported by an orbit CAPCOM. This panel meets monthly to develop techniques and flight rules used during orbit flight phases. The MIR Flight Techniques Panel is supported by a rendezvous–qualified CAPCOM. This panel meets monthly to develop techniques and flight rules used during the MIR docking missions.

n. **Flight Rules Change Board** – The Flight Rules Change Board is supported by a CAPCOM. This board meets bimonthly to review flight rules changes applicable to each mission.

4.2.3 Astronaut Office Support of Mission Specific Payloads Development

The development of a payload for a specific mission begins with a review of the NASA Form 1628, which is used to evaluate the potential payload for operational feasibility for a flight on the Space Shuttle. FCOD provides input to this evaluation, and may interact with the payload developer in order to provide design or operational guidelines before the NASA Form 1628 evaluation is submitted. From this point in time, FCOD is actively involved with the payload developer in enhancements, computer displays (both POC and MCDS), flight techniques, timelines, and documentation such as the PIP and FRD.

Many of these early developmental meetings are working group level meetings which are not supported. More formal meetings such as the Payload Operations Working Group (POWG), SWG, and IWG are supported by FCOD. In addition, many engineering reviews, design reviews, safety, Technical Interchange Meetings (TIMs) and other technical reviews for the payload involve representatives from FCOD. The operational aspect of the payload may be further developed at flight rule, flight technique, timeline, and other meetings. Various aspects of the payload must be properly documented. FCOD participates in PIP reviews (which also include training templates, computer display requirements, and FDF procedure requirements), FRD reviews, payload procedure reviews, and review other payload documentation to ensure that all requirements are met.

4.2.4 Astronaut Office Support of the Space Shuttle Safety Organization

The Astronaut Office provides a representative to three safety panels: Systems Safety Review Panel (SSRP), Payload Safety Review Panel (PSRP), Prelaunch Assessment

Review (PAR) Panel. The SSRP reviews and recommends PRCB disposition of Space Shuttle hazards, integrated cargo hazards, IFAs from preceding missions, and other technical issues associated with the Space Shuttle Systems. The PSRP ensures that either all payload requirements are met (or that any noncompliance is justified) and provides a recommendation on disposition to the PRCB. The PAR panel reviews the profile and any technical issues associated with the upcoming missions in support of the Associate Administrator for Safety and Mission Assurance.

The Astronaut Office provides a member of the Mishap Investigation Team (MIT) which stands by for each mission. This team member has received formal mishap investigation training.

4.3 AIRCRAFT OPERATIONS DIVISION (AOD)

The AOD provides mission support aircraft for nominal and contingency use. This includes the responsibility to ensure that all aircraft are current in inspection and maintenance, and that all flight crew and maintenance personnel have completed certification and are current. The AOD also provides Shuttle pilot approach/landing training in the Shuttle Training Aircraft and KC–135 to support the crew training plan.

4.3.1 Shuttle Training Aircraft (STA)

AOD provides an STA for Shuttle pilot approach/landing training and for launch/landing weather reconnaissance. Normally two STAs will deploy to KSC for prelaunch crew training and launch weather reconnaissance. Deployment will be scheduled to support all prelaunch STA crew training requirements which will include at least one training flight for the crew pilots on either L–2 or L–1 day. Extra training flights will be added as required for launch scrubs/delays to provide recent Shuttle approach/landing training for the astronaut pilots prior to launch. One STA will be scheduled to support launch weather reconnaissance which will report weather conditions, wind data, projected Shuttle landing performance, landing aid status, and other requested data for the launch site area and the Shuttle Landing Facility (SLF) runway. Normally, an STA will be deployed to both the prime and backup landing sites for landing weather conditions, wind data, projected Shuttle landing performance for available runways, landing aid status, and other requested data for that landing site.

4.3.2 T–38 Aircraft

AOD provides T–38 aircraft for astronaut space flight readiness training. This training develops and maintains proficiency required for Space Shuttle operations.

4.3.3 Shuttle Carrier Aircraft (SCA) for Ferry Operations

For each launch, one of two SCA aircraft and required flight crews are maintained in a flight–ready status to support ferry operations in the event the Shuttle lands at some field other than the SLF at the KSC. This aircraft is maintained at the DFRC at EAFB.

4.3.4 KC–135 Support Aircraft

The KC–135 aircraft and flight crew are available for crew return from TAL or transportation of Emergency Mission Control Center (EMCC) personnel/equipment. If the KC–135 is unavailable, the SSP Office coordinates with Department of Defense (DOD) to have an aircraft on standby.

4.3.5 Approach/Landing Training

The AOD provides approach/landing training for pilot astronauts in the STA and KC–135. Mission–specific approach/landing training for pilot astronauts will be provided in the STA prior to their Shuttle flight, as outlined in JSC 18297C, STA Flight Session Plans, Mission–Specific Training Series. This training will be accomplished using mission–specific Orbiter landing weights/center–of–gravity and mission–specific flight software I–Loads affecting approaching and landing guidance/ navigation modes. Mission–specific training in the STA will include training at both the prime and backup landing sites, day and night training flights, and training for contingency landings. The KC–135 aircraft is used to provide Shuttle pilots with training in the characteristics of heavy aircraft in the landing and rollout task.

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APPENDIX L

KSC INTEGRATION
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX L

KSC INTEGRATION
FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

1.1 PURPOSE

The KSC Integration FPPP defines the processes and products the contractor and/or NASA certify in support of the SSP Certification of Flight Readiness.

1.2 SCOPE

This appendix describes the processes and associated products KSC Integration is responsible to develop, review, and certify for flight.

2.0 RESPONSIBILITIES

The following sections describe the processes and products KSC Integration is responsible for developing. It also includes the processes KSC Integration participates in, in order to ensure their readiness for flight. Shared NASA/contractor activities are documented in SSD95D0205.

2.1 INTEGRATED REQUIREMENTS DEFINITION

2.1.1 Drawings

Requirements are approved in related integrated vehicle configuration drawings.

The Space Shuttle KSC Integration Office approves the PRCBD which documents the Space Shuttle Systems Level Drawings for each mission. This directive approves the release of these drawings which are then input into program data bases for requirements definition and closed–loop tracking.

Input: Flight Definition and Requirements Directive (FDRD); Flight Requirements Document (FRD); PRCBDs; Cargo Integration Reviews (CIRs); Launch Site Flow Reviews (LSFRs); Launch Site Requirements Reviews (LSRRs); Crew Compartment Configuration Drawings (CCCDs); Drawing Change Notices (DCNs); Time Compliance Technical Instructions (TCTIs); Change Control Board Directives (CCBDs); Engineering Change Proposal (ECP); Master Change Record (MCR); Field Engineering Change (FEC) notices.

Output: Directive which approves the release of V072–000001, Space Shuttle System drawings; V072–300055, ferry configuration drawings; CR releasing system level drawings.

2.1.2 Flow Requirements

Coordinate and integrate the LSRR/Flow Review packages. Coordinate the requirements identified through the Flow Review Working Group and forward the necessary items to the PRCB for approval.

Input: Mass properties; Orbiter proposed modifications; payload integration hardware changes and issues; SSME proposed engines; OMRS mission–specific requirements; RSRM proposed changes; SRB proposed changes; Cargo Flow Plan; STS Flow Plan.

Output: PRCBD baselining the flow requirements and STS Flow Plans.

2.1.3 Launch Commit Criteria (LCC)

LCC requirements identified are defined and approved.

All LCNs to the LCC identified are approved to support the launch countdown. All LCNs are processed through the LCC Working Group and submitted to the Special Daily PRCB for approval (reference NSTS 16007, Appendix B).

Input: New or revised LCC requirements due to hardware modifications mission–specific requirements, procedural changes, improved launch probability, clarifications, anomalies, or LCC violations.

Output: LCN approval.

2.1.4 Operations and Maintenance Requirements and Specifications (OMRS)

All requirements identified (excluding File II, Volumes 2, 4, and 6, File III, [except Volume 41], File VII, File VIII, and File IX, Volume 2 [except Appendix B]) are approved. All requirements changes are incorporated in OMRSD.

All RCNs (with exclusions as noted above) to the OMRS identified are approved and incorporated to support processing. All applicable RCNs are processed through the OMRS Working Group and submitted to the Special Daily PRCB for approval. All changes are incorporated in the OMRS document.

All mandatory RCNs to OMRS File II, Volume I, are identified, approved, and incorporated or are scheduled for incorporation. The process includes generation of new requirements and technical evaluation of RCNs to assure system checkout requirements are correctly defined and implemented.

Input: New or revised OMRS requirements due to hardware modifications, mission–specific requirements, procedural changes, flow enhancements, clarifications, anomalies or OMRS violations.

Output: NSTS 08171, OMRSD. Approved (with exclusions as noted above) and incorporated OMRS revisions.

2.1.5 Ground Software

Flight hardware/software requirements which are new or revised affecting ground processing software are properly incorporated into KSC documentation.

All Criticality 1, 1R, or 1S LPS software changes listed in the Change Implementation Assessment Record (CIAR) packages presented to the Technical Review Panel (TRP) are evaluated for proper disposition and approval. The SSP voting member (reference NSTS 07700, Volume IV) provides integration representation at the TRP and insures proper technical definition of software requirements for related program directives. The TRP board member is responsible for ensuring ground system changes are coordinated with the flight software and for forwarding the results to the Space Shuttle Vehicle Engineering Organization.

Input: CIAR packages.

Output: Verification that GOAL software requirements are correctly defined.

External Output: Output is submitted to Space Shuttle Vehicle Engineering at the Software Readiness Review and to the Space Shuttle KSC Integration Office and Space Shuttle Vehicle Engineering for major review milestones including the FRR and PMMT Reviews.

2.2 COMBINED VEHICLE HARDWARE REQUIREMENTS IN KSC DOCUMENTATION

Flight hardware integrated requirements (OMRS File II, Volume I) which are new or revised are properly incorporated into KSC documentation.

OMRS File II, Volume I RCNs, are evaluated for integrated system impact. Items affecting element interfaces are compared to integrated procedures, and sub–task documents if necessary, to verify required changes are properly incorporated prior to need date. Inter–element and intra–element issues are identified and resolved to preclude realtime deviation to procedures, processing delays, and potential for testing errors that may harm personnel or hardware.

Input: OMRS File II, Volume I RCNs.

Output: NASA–KSC Integration approval for TOPs deviations and Interim ICRs.

2.3 NONCONFORMANCES

2.3.1 Program Material Review Board (PMRB)

All hardware nonconformances which are presented to the PMRB are evaluated, properly dispositioned, and approved.

All flight hardware nonconformances presented to the PMRB are evaluated for proper disposition and approval. The SSP voting PMRB member (reference NSTS 07700, Volume IV) provides an integration assessment for voting decisions and coordinates issues with Space Shuttle Systems Integration and Space Shuttle Customer and Flight Integration. This process assures hardware nonconformances are acceptable for flight, thereby minimizing technical, schedule, cost, and safety risks.

Input: PMRB agenda and presentation materials.

Output: PMRB NASA–KSC Integration approval signatures.

External Output: Coordination of Systems Integration and Customer and Flight Integration impacts prior to PMRB signature.

2.3.2 Operations and Maintenance Requirements and Specifications (OMRS)

All OMRS waivers and exceptions presented to the Special Daily PRCB or Vehicle Engineering Control Board are evaluated for proper disposition and approval. The KSC Integration voting member provides an integration assessment for voting decisions.

Input: OMRS waivers and exceptions.

Output: NASA–KSC Integration approval signatures.

2.3.3 Unexplained Anomalies (UAB)

All UAs which are presented to the Unexplained Anomaly Board (UAB) are evaluated, properly dispositioned and approved.

The SSP voting UAB member provides the integration assessment for voting decisions. This process assures UAs are acceptable for flight, thereby minimizing technical, schedule, cost, and safety risks.

Input: UAB agenda and presentation materials.

Output: UAB NASA–KSC Integration approval signatures.

2.3.4 Launch Commit Criteria (LCC)

All identified LCC deviations are evaluated, properly dispositioned, and approved for launch countdown.

Known anomalous conditions of flight–specific or support hardware, which will cause an LCC violation, are identified, pre–coordinated, approved, and implemented with an LCC deviation.

Input: LCC violation or a late requirement is identified by the project.

Output: Recommendation for LCC deviation.

2.3.5 Issues and Concerns

All other known anomalies and special issues which are the concern of NASA–KSC Integration are evaluated, properly dispositioned, and approved.

Issues and concerns are investigated to determine program integration impacts. Interim Problem Reports (IPRs)/Problem Reports (PRs) are evaluated for integrated issues and/or program effect. Special studies and reports are developed and presented with analysis and recommendations. Fault tree development, panels and technical meetings are coordinated to develop rationale and effect resolution. Items addressed are potential safety, schedule, and cost drivers.

Input: Daily IPR/PR reports; daily KSC operations and engineering status; daily systems engineering contact; Daily Status/Actions Report; Daily Operations Status Report.

Output: Documented anomaly/issue evaluation results or recommendations.

2.4 AUDIT, INSIGHT AND SURVEILLANCE

2.4.1 Mission Requirements Control System (MRCS)

An audit of the MRCS data base has been performed to ensure the program configuration requirements have been entered and all incompatibilities are resolved.

Input: MCPP, Red Flags, Concern Flags, and change logs.

Output: Verification that configuration requirements have been properly entered into MRCS and that incompatibilities are resolved.

2.4.2 Ground Software

The TRP SSP voting member has completed audits of the Ground System Software Change process for proper implementation of changes and verification that the software configuration is correct for flight. All nonconformances have been identified and dispositioned for flight.

2.4.3 Ground Support Equipment/Facility Change Integration Compatibility

An audit of compatibility of significant modifications to facilities and GSE with the integrated launch vehicle has been conducted and discrepancies have been resolved.

2.4.4 Out–of–family Issues

Out–of–family issues identified by the contractor have been evaluated and properly dispositioned for flight.

2.5 KSC INTEGRATION FLIGHT READINESS REVIEW

NASA–KSC Integration Pre–FRR is satisfactorily completed.

A Pre–FRR is completed by all functions to verify that work in support of NASA–KSC Integration is complete or scheduled for completion before launch. An integrated Pre–FRR is conducted between NASA–JSC, Space Shuttle Systems Integration Office, and the integration contractor prior to the formal CoFR. All open work or issues are identified and any waivers, deviations, or exceptions are dispositioned and approved. A certification statement is signed.

Input: Mission–specific technical assessments.

Output: Flight Preparation Readiness statement.

APPENDIX M

SPACE SHUTTLE SYSTEMS INTEGRATION OFFICE
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX M

SPACE SHUTTLE SYSTEMS INTEGRATION OFFICE FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

This appendix defines the processes and products the Space Shuttle Systems Integration Office certifies in support of the SSP Certification of Flight Readiness.

2.0 SYSTEMS INTEGRATION FPP

2.1 ASCENT DESIGN REQUIREMENTS

The JSC/SSP/Flight Systems Analysis Office jointly participates in the ascent flight design process through its Ascent Flight Systems Integration Group (AFSIG) with JSC/MOD/Flight Design and Dynamics Division and JSC/SSP/Space Shuttle Manifest and Schedules Office. The AFSIG reviews and approves all non–standard mission–specific ascent flight design and generic changes to flight design requirements definition and criteria.

Input: Non–standard flight design requirements and generic ascent design requirements and criteria changes.

Output: Changes to ascent design requirements definition and criteria documents.

2.2 DOSS MISSION CHANGES

The NSTS 08329, Volume VIII, defines the requirements for operational DOLILU support. The AFSIG, chaired by the JSC/SSP/Flight Systems Analysis Office, coordinates and reviews changes to the DOSS process that originate with the Space Shuttle Systems Integration Office, JSC/MOD/Flight Design and Dynamics Division, MSFC, and KSC, with subsequent change approval at the ICB/PRCB.

Input: NSTS 08329, Volume VIII, PRCBDs.

Output: CRs, software and data bases.

2.3 (DELETED)

2.4 SYSTEMS INTEGRATION OUT–OF–FAMILY ACTIVITIES

2.4.1 In–flight Anomalies (IFA)

Any IFA involving systems integration from the last mission and all other open out–of–family integration anomalies are reviewed for risk impact to the upcoming flight. Next flight acceptability is determined and presented to the ICB prior to the FRR.

Input: PRCB IFA baseline; SSRP IFA review; flight problem reports.

Output: Assessment results; flight acceptance rationale.

2.4.2 Requirement Changes, Waivers, Deviations and Exceptions

Changes to the NSTS 07700, Program Definition and Requirements Documents, requirements have been reviewed for applicability to the mission and have been appropriately dispositioned.

Waivers and deviations to the NSTS 07700, Program Definition and Requirements Documents are written and approved by the PRCB. The Systems Integration Office provides analyses and rationale to assure safe flight can be achieved with the waiver/deviation. Exceptions to the requirements are provided when changes to the configuration or planned flight operations are generically acceptable.

The Systems Integration Office reviews and approves mission waivers to ICD–2–19001, Attachment 1, deviations and exceedances applicable to payload unique ICDs. Waivers to the ICDs are presented to the PRCB for approval.

Input: Issue identification, Preliminary Interface Revision Notice (PIRNs).

Output: Approved waiver/deviation/exceedances/exception.

2.4.3 Flight Hardware Problem Resolution

All flight hardware problems/issues that are first time occurrences that limit or restrict re–use, or that affect performance/reliability or safety are reviewed and plans defined for problem resolution using the Systems Integration contractor and/or appropriate government engineering organization. Problems are evaluated, analyses reviewed and appropriate recommendations made for acceptance of problem resolution. All ALERTs requiring systems integration evaluations have been evaluated and flight acceptance has been determined.

Input: Problem reports/IFAs, ALERTs.

Output: Problem resolution documentation; acceptability for flight.

2.4.4 Issue Resolution and Risk Assessment

A risk assessment is performed for issues/PRs/UAs to determine program risk impacts and to provide recommendations for risk mitigation. Rationale for safe flight is developed. The risk assessment process is conducted for evaluation of all waivers and deviations to PRs generated.

Input: Problem and anomaly reports.

Output: Risk assessment results; flight acceptance rationale.

2.5 SYSTEMS ICD

Changes to Shuttle Vehicle element interfaces and vehicle–to–ground system interfaces are dispositioned by the Space Shuttle Systems Integration Office as delegated by the ICB.

Input: IRNs reflecting ICD violations or new requirements.

Output: Dispositioned IRNs.

2.6 LOADS, THERMAL, AND EMC VERIFICATION FOR MIR FLIGHTS AND ISS ASSEMBLY FLIGHTS

The JSC/SSP Integration Engineering Office is responsible for on–orbit environments development including on–orbit loads, Environmental Control and Life Support System (ECLSS), and active/passive thermal analyses in support of STS missions for Mir and ISS. On–orbit verification loads analysis of the mission–specific configuration (within 1,000 feet of ISS or Mir structure) is performed. Flight loads and deflections for Orbiter/Mir or ISS configuration are generated to verify structural compatibility with the planned mission environment/operation and to ensure flight safety. On–orbit stability/control and Reaction Control System (RCS) plume analyses in support of mission verification are performed. Digital Autopilot (DAP) parameters and plume impingement loads are generated for the on–orbit mated system RCS loads analysis. Math models and analysis results are documented in formal reports. The verification process is considered to be completed with the conclusion of the Verification Acceptance Review (VAR), and with the documentation of all issue resolutions resulting from the meeting.

Verification thermal (passive/active and ECLSS) analyses/assessments of the flight–specific configuration are performed. Predicted temperature responses and other parameters are generated to verify thermal (active/passive) compatibility with the planned mission environments/operations and to ensure mission success and safety of flight. On–orbit, docked (within 1,000 feet of ISS or Mir structure) passive thermal and mated system air revitalization analyses are performed to support flight verification.

Models and analyses results are documented in formal reports. Compatibility is confirmed by evaluating and documenting late mission changes as well as the final flight plan. The verification process is completed by participating in the on–orbit VAR and by supporting the resolution of any issues from the on–orbit VAR.

Input: PIPs; ICDs; FRD; Joint Agreement Documents (JADs); math models; attitude/activity timelines for Orbiter/Mir/ISS missions; DAP parameters; plume model; ECLSS operational/mission model; Orbiter/Mir or Orbiter/ISS stage mated system structural math models.

Output: Loads and thermal analysis results/verification analysis reports; VAR presentations/documentation; plume impingement loads/models; and flight control and stability analysis.

The EMC analyses are conducted to ensure that Mir–Orbiter and ISS–to–Orbiter reconfiguration does not cause any Orbiter EMI problems. A RF analysis is conducted and an electrostatic discharge assessment for the mission is completed.

Input: Transmitter/receiver/antenna data; EMI/EMC test or analysis reports; VA, VD, and VS drawings; JADs.

Output: RF beat frequency analysis; Electrostatic discharge assessment, unintentional radiation and conducted emissions (steady state and transient noise) assessment.

2.7 PAYLOAD INTEGRATION GOVERNMENT–FURNISHED EQUIPMENT CERTIFICATION

Completed Safety and Mission Assurance certification approval reports for GFE hardware, managed and developed by the Space Shuttle Systems Integration Office, are reviewed by the ICB of the Space Shuttle Systems Integration Office for compliance with requirements.

Input: Safety and Mission Assurance certification approval request.

Output: Signed hardware certification.

2.8 INTEGRATED AVIONICS

This section addresses the FPP of the Space Shuttle Systems Integration Office for ensuring the avionics hardware is integrated for a specific Mir or ISS assembly mission. This section summarizes the flight readiness process for:

a. Integrated Avionics

b. Electromagnetic Effects

2.8.1 Avionics Hardware Integration Activities

Integrated avionics systems consisting of Orbiter–to–Mir or Orbiter–to–ISS (during assembly flights) avionics integration are assessed to verify the Space Shuttle avionics hardware interfaces meet all program and mission avionics requirements for flight. This process includes resolution of waivers, deviations, and restricted hardware dispositions; satisfaction of flight hardware avionics requirements, discrepancies, and problems; and review of operational flight rules and LCC. All applicable program requirements documentation are reviewed to verify that all avionics interface changes have been completed and verified. All integrated avionics open work and issues are resolved prior to flight, and any constraints to flight are identified.

Input: JADs; waivers; deviations; flight products documentation; hardware/software documentation; integrated avionics and software systems requirements.

Output: Integrated avionics interface evaluations; Joint Flight Rules.

2.8.2 Electromagnetic Effects (EME)

EMI/EMC, electrostatic discharge, and lightning and ionizing radiation analyses are assessed to verify that the Orbiter–to–ISS or Orbiter–to–Mir meets all EME program and mission requirements for flight. This process includes resolution of waivers, deviations, and restricted hardware dispositions; satisfaction of flight hardware EME requirements, discrepancies and problems; EME hazard closure; and CIL retention rationale. All EME open work and issues are resolved prior to flight, and any constraints to flight are identified.

Input: Status of JSC/SSP/Integration Engineering Office EME activity; waivers; deviations; test reports; flight products documentation; SSP system EME requirements.

Output: EME technical area manager’s acceptance of all compatibility analyses.

3.0 READINESS REVIEW FOR FLIGHT

The Space Shuttle Systems Integration Office, in conjunction with the SFOC contractor, conducts a readiness review for each flight. The review covers all the areas of responsibilities and the FPP assigned to the office.

Also at this time, the technical managers from the JSC Engineering Directorate, MOD, and the JSC/Space Shuttle SR&QA Office each provide a technical assessment in their area of responsibility as appropriate for out–of–family situations.

Input: Mission–specific technical assessments.

Output: Pre–FRR presentations, readiness statements.

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APPENDIX N

FLIGHT PREPARATION PROCESS FOR
CUSTOMER AND FLIGHT INTEGRATION
AND THE PAYLOAD SAFETY REVIEW PANEL

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FIGURES

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APPENDIX N

FLIGHT PREPARATION PROCESS
FOR CUSTOMER AND FLIGHT INTEGRATION
AND THE PAYLOAD SAFETY REVIEW PANEL

1.0 CUSTOMER AND FLIGHT INTEGRATION

This FPPP is to document the activities of the Space Shuttle Customer and Flight Integration. This organization provides the overall management of payload integration and flight requirements activities from request for flight assignment through post–flight product delivery.

1.1 CUSTOMER INTEGRATION ACTIVITY

When a prospective customer has negotiated a formal agreement with NASA Headquarters, a Payload Integration Manager (PIM) is assigned. The PIM will make initial contact with the payload customer in order to negotiate and document the specific payload requirements and their compatibility with the established SSP accommodations and policy. Through a series of meetings with the payload customer, this organization ensures that physical interfaces and hardware requirements for payloads/carriers to mate with the Orbiter interfaces are consistent with SSP payload requirements. The PIM participates in the customer's PDRs and CDRs and various interface working groups (e.g., Payload Operations Working Groups [POWGs], Technical Interchange Meetings [TIMs], etc.) with other organizations to ensure SSP involvement in the hardware/software and operations development.

NSTS 07700, Volume XIV, Space Shuttle System Payload Accommodations and Appendices are the basis for the definition of the physical interfaces and interface requirements. The appendices are:

Appendix 1: Contamination Environment
Appendix 2: Thermal
Appendix 3: Electrical Power and Avionics
Appendix 4: Structures and Mechanics
Appendix 5: Ground Operations
Appendix 6: Mission Planning and Flight Design
Appendix 7: Extravehicular Activities
Appendix 8: Payload Deployment and Retrieval System
Appendix 9: Intravehicular Activities
Appendix 10: Integration Hardware

These series of meetings culminate in an official technical agreement between the SSP and the payload customer documented in an integration plan. The integration plan will:

a. Define SSP and payload customer responsibilities.

b. Establish guidelines and constraints for integration and planning.

c. Define integration tasks to be accomplished.

d. Establish interface verification requirements.

e. Establish operational services requirements.

f. Establish controlling schedules for all major integration activities.

g. Identify SSP flight and ground safety requirements.

h. Establish the basis for SSP definition and pricing of non–standard services.

The integration plan is signed by both the SSP and the payload customer and is under configuration control. Authority for baselining and changing the integration plans is documented in the NSTS 07700, Volume IV.

Standard Integration Plans (SIPs), also referred to as blank books, have been developed to serve as guides for preparation of the customer integration plans. SIPs have been developed for each generic type of payload (e.g., deployable, mid–deck, etc.). The SIP contains technical requirements, management interfaces, services, and schedules that apply to that type of payload.

1.1.1 Payload Safety Activity

The payload and Airborne Support Equipment (ASE) design, including interfaces and operations, will comply with the requirements of NSTS 1700.7B, Safety Policy and Requirements for Payloads Using the Space Transportation System. The payload safety process is the responsibility of the Payload Safety Review Panel (PSRP). Space Shuttle Customer and Flight Integration coordinates the customer involvement in the safety process and customer responses to integrated cargo hazard analyses action items. Non–compliance reports, if needed, are developed and, after PSRP review, are presented to the SSP for program acceptance. The safety process is documented in the integration plan. NSTS/ISS 13830, Payload Safety Review and Data Submittal Requirements for Payloads Using the Space Shuttle and International Space Station, documents the process for the payload customer. Reference Payload Safety Flight Preparation Process, Section 2.0.

1.1.2 Interface Verification and Testing

All payload–to–Orbiter interface verification requirements are identified and submitted by the customer. These requirements become a part of NSTS 08171, Operations and

Maintenance Requirements and Specifications Document (OMRSD), File II, Volumes 2, 4, and 6. Interfaces that cannot be verified prior to flight will be documented as a waiver or exception in the OMRSD. This document is under configuration control and disposition authority is delegated to the Manager, Space Shuttle Customer and Flight Integration.

1.1.3 Launch Commit Criteria (LCC)

Payload LCC will be developed in accordance with NSTS 07700, Volume XIV, Appendix 5, Requirements and Constraints. The customer submits LCC identifying the parameters, limits, and rationale used as a basis for a launch hold. After review and approval, the LCC will be documented by the SSP in NSTS 16007, Shuttle Launch Commit Criteria and Background Document.

1.2 FLIGHT DEFINITION AND REQUIREMENTS ACTIVITY

1.2.1 Flight Definition

Based on the Flight Assignment Working Group (FAWG) planning manifest, primary and complex secondary payloads with compatible orbital requirements and configurations are manifested consistent with applicable groundrules, constraints, and guidelines of the SSP. The specific payload complement for each flight is documented in NSTS 07700, Volume III, Table 4.1, by the Flight Integration Manager (FIM) assigned by Space Shuttle Customer and Flight Integration for that flight. Other requirements documented are mission duration based on the objectives of the specific payloads, number of crewmen, consumables, inclination and altitude. The compatibility of the Orbiter services are also considered. Baseline of the mission complement in the FDRD is the initiation of the flight production process. The FDRD is an SSP document controlled by the PRCB.

1.2.2 Flight Requirements

The payload complement and mission–specific requirements are developed, assessed, and documented in the flight–specific FRD by the FIM. The objectives of the flight, primary flight requirements, payload priorities, core equipment, mission support equipment, mission–unique equipment, number and types of EVAs, manifested DTOs, DSOs, RMEs, and Human Exploration and Development of Space (HEDS) Technology Demonstrations (HTDs) are documented in the FRD. The FRD is evaluated by the flight–specific Integrated Product Team (IPT) and dispositioned by the Flight Manager. Flight design groundrules and constraints for a specific flight are documented in Appendix A of the FRD. These groundrules and constraints are generated and approved by MOD and concurred on by the Space Shuttle Customer and Flight Integration Office.

1.2.3 Cargo Integration Review (CIR)

The CIR activities are initiated by inclusion of a specific flight in the FDRD and supported by the FRD and the integration plans. The process of cargo integration is a widely based effort to ensure that the total cargo complement for a specific flight is compatible and that all of the associated payload requirements, flight design parameters, and crew activities are within the SSP capabilities. This effort includes assessment of flight and ground system engineering, safety, and all elements of SSP operations. The CIR is a major milestone review, between the SSP and the customer, of this assessment. In addition, the CIR serves as a milestone for manifesting non–standard secondary payloads. The Chair of the CIR has been delegated to the Flight Manager.

1.2.4 Flight Planning and Stowage Review (FPSR)

Space Shuttle Customer and Flight Integration assesses the manifesting of standard secondary payloads and DTOs/DSOs/RMEs/HTDs. This assessment is reviewed and recommendations are made by this organization at the FPSR. The FPSR is a program milestone review that is held to baseline crew activities and crew compartment and cargo bay stowage. It marks the final opportunity to add standard mid–deck payloads and DTOs/DSOs/RMEs/HTDs. The Chair of the FPSR is delegated to the Flight Manager.

1.2.5 Crew Compartment Configuration Review (CCCR)

The CCCR is a milestone to review the crew compartment status for the purpose of (1) preparing for the CEIT and the bench review, (2) baselining the plug–in plans (power, video, and data), (3) verifying the payload DTO/DSO/RME/HTD engineering and hardware delivery, (4) resolving open issues, and (5) freezing the crew compartment configuration. The Chair of the CCCR is delegated to the Flight Manager.

1.3 CoFR ACTIVITY

1.3.1 Anomaly Resolution

As part of the preparation for flight, all flight and ground hardware/software anomalies, including previous in–flight anomalies applicable to this flight and anomalies identified during the payload installation and checkout, will be reviewed, resolved and accepted for flight. The rationale for acceptance of the anomaly resolution is reviewed and a determiniation is made if the current configuration supports the rationale.

Any payload IFA from a previous mission that was assigned an action item from the PRCB must be closed or saved by the PRCB prior to that payload’s next flight. Any procedures and/or in–flight workarounds are reviewed in support of the CoFR.

1.3.2 Payload Customer and Customer and Flight Integration CoFR

In preparation for flight, approximately one week prior to the FRR, the payload customer (outside the ISSP) provides a signed endorsement statement that the requirements stated in the integration plans and supporting documentation have been implemented. Since some of the payloads have late installation and late interface testing, it is expected that some of the statements will have open work noted. A copy of this endorsement statement is included as Figure N–1.

1.3.3 International Space Station Program (ISSP) and Customer and Flight Integration CoFR

In determining the flight readiness with the ISSP, Customer and Flight Integration will meet with representatives of the ISS Mission Integration Office to review documentation, ISS hardware installation status, and any associated problem reports not resolved, open action items from previous reviews, and issues or concerns that might impact launch and/or flight. This meeting, products noted in this appendix, and the results of ISS and Space Shuttle previous CoFR milestone reviews will constitute the basis for certification of flight readiness for the FRR for Customer and Flight Integration.

1.3.4 Customer and Flight Integration CoFR

Prior to the internal MA2 FRR, Customer and Flight Integration will meet with the PIMs and FIM associated with that flight to determine the status of flight readiness. Documentation, LCC, payload installation status, associated problem reports not resolved, open action items from previous reviews, and issues and concerns that might impact launch and/or flight are addressed.

Exceptions noted by the payload customer in their endorsement statements and issues noted during the review with ISSP become part of the Customer and Flight Integration CoFR statement.

FIGURE N–1

PAYLOAD CERTIFICATION OF FLIGHT READINESS

PAYLOAD: ____

This endorsement certifies readiness and worthiness of the payload as of the FRR.

_____________ 1. All exceptions and action items from previous reviews for this payload have been closed/resolved.

_____________ 2. All payload requirements, analyses, and assessments have been defined in the PIP and its annexes and released to support the flight. (All TBDs and TBRs have been resolved.)

_____________ 3. All payload standalone readiness checkout has been successfully completed in accordance with the element and integrated OMRSD.

_____________ 4. All flight and ground hardware/software anomalies, including previous IFAs applicable to this flight and anomalies identified during payload installation and checkout, have been resolved or accepted. All operational workarounds to “fly as is” anomalies have been developed and verified.”

_____________ 5. All payload installation and interface checkout have been successfully completed in accordance with the payload installation and checkout requirements.

_____________ 6. The as–built payload configuration satisfies the released drawing requirements.

_____________ 7. Flight design assessments have been accomplished per the PIP integration schedule and products have been verified and delivered.

_____________ 8. The payload LCC minimum equipment list and mandatory instrumentation lists have been provided.

_____________ 9. No known constraints exist for this payload.

FIGURE N–1

PAYLOAD CERTIFICATION OF FLIGHT READINESS – Continued

______________ 10. Applicable SSP Operational Flight Rules have been reviewed and concurred with for flight.

______________ 11. Applicable sections of the Flight Data File have been reviewed and concurred with for flight.

All payload produced Payload Flight Data File (PFDF) articles have been validated and are ready for flight. All PFDF articles are consistent with the Crew Procedures Management Plan, Appendix F, Space Shuttle Flight Data File Preparation Standards or equivalent.

______________ 12. All Payload Operations Control Center (POCC) facilities and/or customer provided GSE are certified and ready to support the flight.

______________ 13. All payload personnel supporting realtime operations have completed applicable training and/or certification programs and are prepared to support realtime operations in accordance with applicable Joint Operations Interface Procedures and Flight Rules.

______________ 14. All payload personnel with ground command responsibility are aware of the function, utilization and constraints associated with all of the commands in their inventory.

______________ 15. All customer provided payload training sessions for the flight crew and flight controllers have been successfully completed in accordance with the agreements described in the PIP. The flight crew is prepared to operate the payload.

______________ 16. All payload safety hazard controls have been implemented and verified, or are scheduled for implementation and will be tracked via the Verification Tracking Log.

______________ 17. The in–cabin payload hardware is certified acceptable for toxicological effects on the crew. Any changes to the configuration which affect the toxicological assessment will be/have been reported to the SSP per JSC 25607, Requirements for Submission of Test Sample Materials Data for Shuttle Payload Safety Evaluations.

FIGURE N–1

PAYLOAD CERTIFICATION OF FLIGHT READINESS – Concluded

______________ 18. The final weight and mass properties of the payload, as installed in the Orbiter, have been incorporated into the PIP Annex 1, Payload Data Package.

This endorsement certifies payload readiness for the STS–___ Mission, contingent on close–out of any exceptions noted herein.

____
Payload Manager

EXCEPTIONS:

2.0 PAYLOAD SAFETY REVIEW PANEL (PSRP)

2.1 PSRP RESPONSIBILITY

It is the responsibility of the PSRP to interface with the responsible Payload Organization to review the payload for adequate safety implementation. It is also the responsibility of the SSP to assure that interaction among mixed payloads, and between payload and the Space Shuttle, does not create a hazard.

2.2 IMPLEMENTATION

NSTS 1700.7B identifies the safety policy and requirements which are to be implemented by the Payload Organization. The implementation of safety requirements by the Payload Organization will be assessed by the PSRP during the safety review process and must be consistent with the hazard potential. The PSRP assessment of safety compliance will include a complete review of the Safety Assessment Reports (Paragraph 301) and may include audits and safety inspections of flight hardware. The detailed interpretations of these safety requirements will be by the PSRP, and will be determined on a case–by–case basis consistent with the payload's hazard potential.

2.3 IMPLEMENTATION PROCEDURE

NSTS/ISS 13830, a jointly issued JSC and KSC document, has been published to assist the payload organization in implementing the system safety requirements and to define further the safety analyses, data submittals, and safety assessment review meetings. NSTS/ISS 13830 identifies the respective roles of the SSP Flight Operator and the SSP Launch/Landing Site Operator. It reflects a basic policy of commonality, compatibility, and coordination between the SSP flight and ground elements in the implementation effort.

2.4 SAFETY ANALYSIS

A safety analysis shall be performed in a systematic manner on each payload, its GSE, related software, and ground and flight operations to identify hazardous subsystems and functions. The safety analysis shall be initiated early in the design phase and shall be kept current throughout the development phase. A Safety Assessment Report which documents the results of this analysis, including hazard identification, classification, and resolution, and a record of all safety–related failures, shall be prepared, maintained, and submitted in support of the Safety Assessment Reviews conducted by the PSRP in accordance with Paragraph 304. Detailed instructions for the Safety Analysis and Safety Assessment Reports are provided in NSTS/ISS 13830.

2.5 SAFETY ASSESSMENT REVIEW AND SAFETY CERTIFICATION

Safety Assessment Reviews will be conducted by PSRP to determine compliance with the requirements of this document. An initial contact meeting will be held at the earliest appropriate time and will be followed by formal review meetings spaced throughout the development of the payload and its GSE. The depth, number, and scheduling of reviews will be negotiated with the Payload Organization and will be dependent on complexity, technical maturity, and hazard potential. The KSC and JSC Phase III Safety Reviews and Ground Safety Certification must be completed 30 days prior to delivery of the payload, ASE, and GSE to the launch site, except as noted in NSTS/ISS 13830. The Ground Safety Certification shall include statements that the payload GSE and ground operations are safe and in compliance with SSP ground safety requirements and that open safety verifications from the JSC Safety Reviews for payload design and flight operations will not affect safe ground operations. Rationale for acceptance of open flight verification during ground operations must be submitted by the Payload Organization with the Ground Safety Certification statement and approved by the SSP Launch/Landing Site Operator prior to the start of ground processing. The Flight Safety Certification shall be submitted at least 10 days prior to the FRR. The Flight Safety Certification shall include statements that the payload design and flight operations are safe and are in compliance with the SSP Safety Requirements of this document.

2.6 PSRP CHAIR FLIGHT READINESS PROCESS

The PSRP Chair will submit a readiness statement in support of the FRR that will define the status and readiness of the flight payload safety process. The CoFR statement is shown in Figure N–2.

FIGURE N–2

PSRP CoFR STATEMENT

MA2/PAYLOAD SAFETY

CERTIFICATE OF FLIGHT READINESS (Baseline of 5/5/93)

This Flight Readiness endorsement certifies that the completed activities and remaining open work required for flight of the SSV, flight crew and payloads, as defined by baselined SSP requirements and documentation, have been reviewed and approved. This Certification of Flight Readiness includes, but is not limited to the following items:

________ a. All safety hazard reports are approved.

________ b. Waivers and Non–Compliance Reports (NCRs) are approved.

________ c. The safety certification process is complete.

This endorsement certifies readiness for STS–____, contingent on close–out of any exceptions noted herein.

____

Manager, Payload Safety

EXCEPTIONS:

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APPENDIX O

SPACE AND LIFE SCIENCES
FLIGHT PREPARATION PROCESS PLAN

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APPENDIX O

SPACE AND LIFE SCIENCES
FLIGHT PREPARATION PROCESS PLAN

1.0 PURPOSE

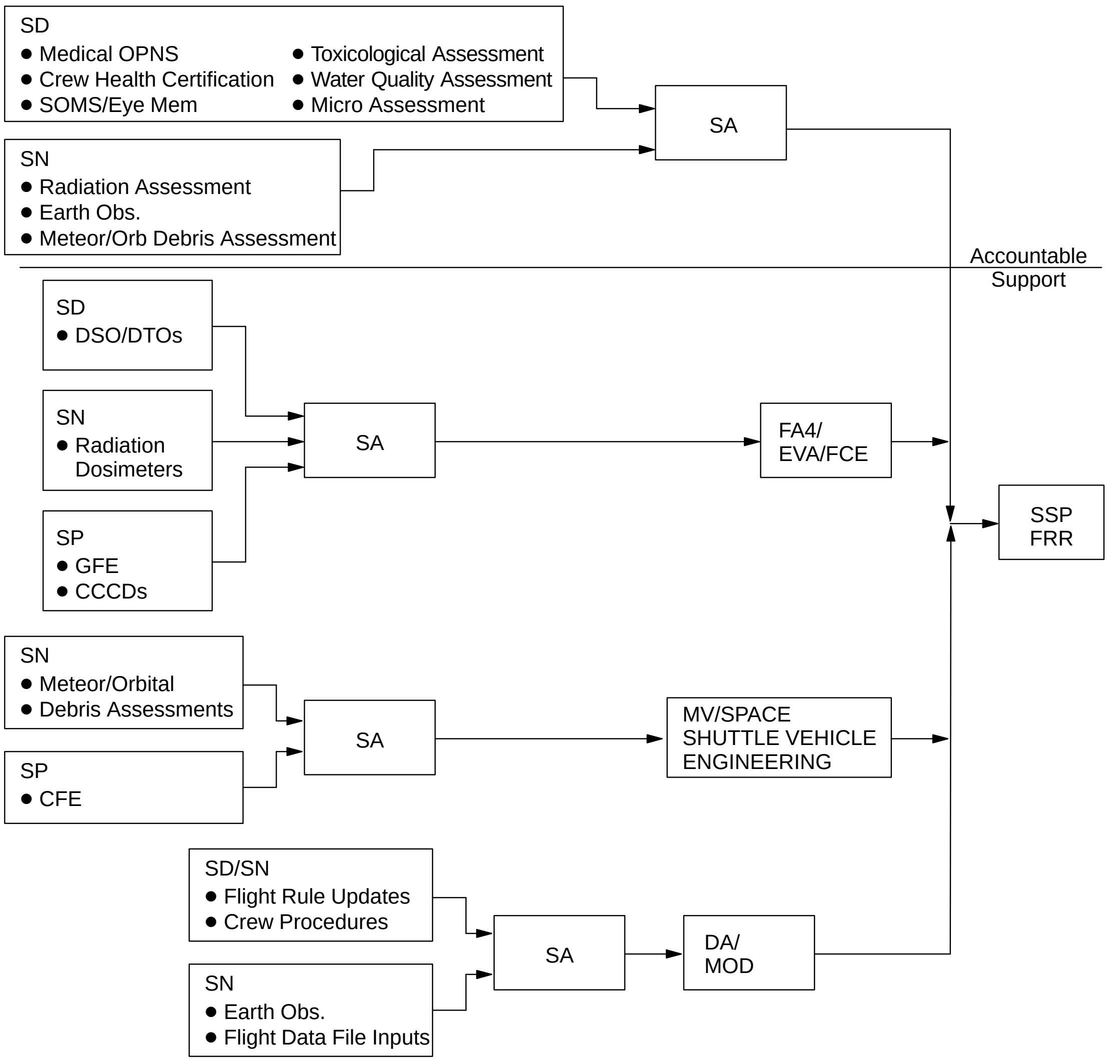
This appendix describes products the Space and Life Sciences Directorate (SLSD) at JSC is responsible for and the processes used to provision these products in preparation and support of Space Shuttle missions.

2.0 SCOPE

The SLSD FPPP includes activities in medical and biomedical operations, medical Detailed Supplementary Objective (DSO)/Developmental Test Objective (DTO), flight crew equipment, radiation, earth observation, meteor/orbital debris. The SLSD has single–string accountability in the areas of medical operations, crew health certification, radiation assessments, earth observation and meteor/orbital debris assessments. Support is provided to other Space Shuttle Projects or elements in the areas of medical DSO/DTO, flight crew equipment and radiation dosimetry. This plan describes the process, requirements and products associated with flight preparation. Figure O–1 is a flow diagram describing the SLSD activities which are single–string accountable and those which support other organizations.

FIGURE O–1

SPACE AND LIFE SCIENCES SINGLE–STRING ACCOUNTABILITY – SUPPORT FLOW DIAGRAM



3.0 PRODUCTS PROVIDED BY SPACE AND LIFE SCIENCE DIRECTORATE

3.1 MEDICAL/BIOMEDICAL OPERATIONS

3.1.1 Flight Crew Health Certification

3.1.2 Shuttle Orbiter Medical System (SOMS) Kit/Crew Eye Wear

3.1.3 Flight Rules/Medical Checklist Updates

3.1.4 Toxicological Assessment

3.1.5 Potable Water Quality Assessment

3.1.6 Microbiology Assessment

3.1.7 Personnel and Crew Training

3.2 MEDICAL DSO/DTOs

3.2.1 Reflown DSO/DTOs

3.2.2 New DSO/DTOs

3.2.3 Certificate of Flight Readiness to EVA/FCE

3.3 FLIGHT CREW EQUIPMENT

3.3.1 Government Furnished Equipment

a. Food/beverage

b. Clothing, soft goods, linens

c. Personal hygiene

d. Galley

e. Optical and photographic equipment

f. Treadmill

g. Personal and off duty equipment

h. Housekeeping equipment

i. Vacuum cleaner

j. Stowage container cushions

k. Decals and placards

l. Electrical measurement device

m. Power distribution panel w/cables

n. Contingency hoses and adapters

o. Lighting equipment

p. GFE In–flight maintenance tools

q. Restraint/reach/mobility aids

r. Trash compactor

s. Food warmer

t. Education equipment

u. Recumbent seat system

3.3.2 Contractor Furnished Equipment

a. Seats

b. Sleep accommodations

c. Stowage lockers/trays

d. Ground emergency egress equipment

e. Crewman optical alignment sight

f. Window shades

g. CFE In–flight maintenance tools

h. Restraints/reach/mobility aids

3.3.3 Configuration Documentation

a. Crew Compartment Configuration Drawings (CCCD)

b. Annex 6 inputs

c. Food installation

d. Photographic equipment stowage

e. Flight photographic equipment list

f. Crew compartment plug–in plan

3.3.4 Certificate of Flight Readiness to EVA/FCE and Orbiter

3.4 RADIATION

3.4.1 Shuttle Radiation Dosimetry Hardware

3.4.2 Crew Radiation Exposure Assessment

3.4.3 EVA Crew Radiation Exposure Assessment

3.4.4 Onboard Radioactivity Assessment

3.4.5 Flight Rules Update

3.5 EARTH OBSERVATIONS

3.5.1 Earth Observation Maps for Flight Data File

3.5.2 Earth Observation Atlas for FDF

3.5.3 Earth Observation MET List for FDF

3.5.4 Special Products and Crew Training

3.6 METEOR AND ORBITAL DEBRIS

3.6.1 Orbital Debris Collision Hazard Assessment

3.6.2 Meteor Shower/Storm Assessment

3.6.3 Orbiter Penetration Risk Assessment

3.6.4 Impact Damage/Repair Assessment

3.7 SLSD FLIGHT READINESS REVIEW

4.0 PROCESSES USED IN PROVIDING THESE PRODUCTS

4.1 MEDICAL/BIOMEDICAL OPERATIONS

Medical/biomedical operations support is provided by the Medical Sciences Division. Products provided by this organization include flight rules/medical checklist updates, flight crew medical equipment, crew health certification, toxicological assessments, water quality assessments, microbial assessments, and operations personnel certification.

4.1.1 Flight Data File/Medical Checklist Updates

The medical checklist is reviewed prior to each mission for improved medical techniques, pharmacological advances/changes, and medical equipment enhancements. Updates to the medical checklist are submitted to the FDF Office at L–16 weeks. Aeromedical flight rules are reviewed each flight and updated according to previous flight experience or anticipated medical situations. Inputs to the flight–specific flight rules annex are submitted to the Flight Director's Office at L–6 weeks.

4.1.2 Shuttle Orbiter Medical System

All medical equipment, except for crew eye wear and personal carry–on medication, flies as part of the Shuttle Orbiter Medical System (SOMS). The following list of equipment is included in the SOMS and is certified preflight by the referenced applicable documentation:

Emergency Medical Kit (EMK)	JSC 16260, JSC 22807
Medication and Bandage Kit (MBK)	JSC 16259, JSC 22807
Medical Extended Duration Orb. Pack (MEDOP)	JSC 25268
Airway Medical Accessory Kit (AMAK)	JSC 25220, JSC 22807
Resuscitator	JSC 22811, JSC 22806, JSC 22809
Contamination Cleanup Kit (CCK)	JSC 22837, JSC 22810, JSC 25784
Operational Bioinstrumentation System (OBS)	NSTS 11091, JSC 22818
OBS FMEA	JSC 22439

The SOMS processing requirements, preflight preparation, shipping procedures and post–flight handling is documented in JSC 23056, Preflight Preparation and Shipping Procedures for Shuttle Orbiter Medical System; JSC 20432, SOMS Post–Flight Handling Document; and JSC 24734, Medical Operations Shuttle Orbiter Medical System Processing Document. Post–flight inspection of the SOMS is required on L+1 day for medical record documentation and inventory. Crew eye wear is prepared and delivered to FEPC at L–5 weeks. A CoFR is provided at the EVA/FCE and SLSD FRR.

4.1.3 Flight Crew Health Certification

Flight crew examinations and circadian shifting schedules are completed preflight as part of crew health certification. The Health Stabilization Program (HSP) is initiated seven days prior to flight to minimize the possibility of in–flight illness in accordance with JSC 22538, Health Stabilization Program for Space Shuttle Program. A preflight physical conditioning and training program is made available which provides supervised strength and conditioning training targeted at mission–specific needs. A rehabilitation program is certified preflight to provide post–flight medical support where needed. Every crew is briefed on the medical aspects of spaceflight in accordance with Medical Procedures 3101A/4101, Toxicology 9101, CPR 2101, and First Aid 2101. In addition, two crew members are designated Crew Medical Officers (CMOs) and receive hands–on medical training involving use of the medical checklist and SOMS medical kits in accordance with Medical Diagnostics 3101, Medical Therapeutics 3101/3201, (see Ops 3120, and Dental Training 3101).

4.1.4 Toxicological Assessment

Before each mission, the JSC Toxicology Group performs toxicity/irritancy hazard assessments on all mission–unique payloads, DSOs, DTOs, RMEs, and utility chemicals that are flown in the spacecraft habitable areas. Non–hazardous chemicals are also assessed by the toxicologists. This assessment is made available to the responsible safety organizations who determine if containment safeguards are adequate for the toxicity/irritancy hazard levels. These data are then compiled into a mission–specific Hazardous Materials Summary Table (HMST), which lists all test materials used in each experiment system or subsystem, along with their container identification, quantity, concentrations, toxic effects, relative flammabilities, hazard levels, and contingency medical procedures to be implemented in the event of their escape and crew exposure. The HMST for each mission becomes a part of the FDF. The final version of the HMST is provided to the crew surgeon and other mission support personnel by L–1 month. Any modification of the chemical list after this time will require a revision to the final HMST.

4.1.5 Potable Water Quality Assessment

The Biomedical Operations and Research Branch performs potable water quality assessments for each mission to ensure compliance with quality requirements specified in SE–S–0073, Specification, Fluid Procurement and Use Control. This responsibility includes the technical oversight of all water system disinfection/servicing procedures, water sampling, and chemical/microbial analyses performed preflight and post–flight by KSC personnel and a parallel verification chemical analysis and identification of microorganisms cultured from the water samples by JSC personnel. The results are provided to the flight surgeons and flight system engineers. A summary report containing system servicing operations, analytical results and assessment of the water quality is prepared 60 days after the mission.

4.1.6 Microbiology Assessment

The Biomedical Operations and Research Branch performs microbiological assess–ments for each mission in accordance with JSC 16888, Microbial Contamination Control Plan. Payloads containing biological specimens such as animals/ microorganisms used in science investigations are reviewed to determine risk and to ensure limits are in accordance with JSC 20483, Human Research Policy and Procedures for Space Flight and Related Investigation. Flight and training foods are evaluated for microbial pathogens. Environmental samples are obtained from the Orbiter/Spacelab/Spacehab air and selected interior surfaces at L–21, L–2, and R+0 to verify preflight cleanup procedures and to ensure a safe environment for crew habitability. A Microbiology Assessment Summary Report is prepared 60 days after the mission.

4.1.7 Personnel Training

Flight surgeons and biomedical engineer flight controllers are certified each mission according to JSC 26546, Medical Operations Flight Support Training and Certification Plan. A Medical Operations Readiness Review (MORR) is conducted in accordance with JSC 16785, Medical Operations Readiness Review Plan, at L–30 and L–7 days to ensure that medical personnel and facilities are operationally ready to support the mission. Medical facilities must be in compliance with JSC 13956, Medical Operations Requirements Document. Non–DOD medical support for L&L must be in accordance with site specific Medical Operations Support Implementation Plans (KSC: KBM–PL–1.1A, Emergency Medical Services Plan – Kennedy Space Center, DFRC: JSC 18288, Medical Operations Support Implementation Plan – Dryden Flight Research Center). DOD medical support must be in compliance with site–specific Medical Operations Support Implementation Plans (KSC: KBM–PL–1.1A, DFRC: JSC 18288, WSSH: JSC 16299, Medical Operations Support Implementation Plan – White Sands Space Harbor; Ben Guerir: JSC 22944, Medical Operations Support Implementation Plan – Ben Guerir, Moracco; Moron: JSC 22945, Medical Operations Support Implementation Plan – Moron, Spain; Zaragoza: JSC 22946, Medical Operations Support Implementation Plan – Zaragoza, Spain; Banjul: JSC 22947, Medical Operations Support Implementation Plan – Banjul, The Gambia).

4.2 MEDICAL DSO/DTOs

Medical DSOs and DTOs are provided by the Medical Sciences Division. Processing of medical DSO/DTOs is dependent on whether it is considered reflown or new hardware.

4.2.1 Reflown DSO/DTOs

The requirements for preparation of hardware for reflight are minimal for medical DSO/DTOs that have previously flown and do not require modification. A review of the hardware certification is conducted with JSC Reliability to verify that the hardware is within the certified number of flights. Part numbers and serial numbers are provided to the JSC Quality Organization and verified that no open paper exist. Re–flight matrix is prepared and approved by NASA Safety. Functional testing of the hardware is performed as a pre–installation acceptance to verify proper operation and configuration prior to delivery. Stowage and structural interface tests, including Crew Equipment Integration Test (CEIT), Terminal Countdown Demonstration Test (TCDT), and bench reviews are supported as required.

4.2.2 New DSO/DTOs

The process for new DSO/DTOs and reflown DSO/DTOs that have been modified are virtually identical. An acceptance/certification requirements matrix is developed with the JSC Reliability Organization and a Space Shuttle criticality analysis is conducted to determine criticality. The matrix and criticality is approved by the Reliability Organiza–tion. All certification and acceptance testing is performed on NASA Test Preparation Sheets (TPS). The JSC Quality Organization verifies, by part number and serial number, that hardware has no open paper before shipment to launch site. Potential hazards are identified and evaluated in preparation of the standardized Hazard Control Report. Safety verification testing is performed to address safety issues. A certification of NSTS Payload Compliance Sheet is completed and submitted to the JSC Safety Organization. Functional testing of the hardware is performed as a pre–installation acceptance to verify proper operation and configuration prior to delivery. Stowage and structural interface test, including CEIT, TCDT, and bench reviews are supported as required. All hardware engineering drawings are prepared in accordance with JSCM 8500.

4.2.3 Certificate of Flight Readiness to EVA/FCE

All flight hardware is processed through the EVA/FCE configuration control board. A CoFR is provided at the EVA/FCE and SLSD FRRs.

4.3 FLIGHT CREW EQUIPMENT

Flight crew equipment is provided by the Flight Crew Support Division. Flight crew equipment consist of GFE, CFE, and configuration documentation for the Orbiter crew compartment.

4.3.1 Government Furnished Equipment

The government furnished items consist of equipment which are utilized in the Orbiter crew compartment and are identified in categories of crew oriented hardware, food systems, galley, cameras, ancillary and stowage provisions. The hardware design reflects the JSC PRDs, PTRSs, and PMPs or equivalent (PRCBDs, CCBDs, TTAs, MOAs, or memos). PTRS and PMP document requirements are shown in NSTS 07700, Volume VI and JSC 61100. NSTS 07700, Volume VI shall supersede JSC 61100 for any requirement conflicts.

Existing PRDs may be used if the requirements of the new FSE hardware/software match the requirements in the existing PRD. The items are processed by a PMP or PTRS formatted per JSC 61100 or, if appropriate, by an existing PRD for Criticality 1 or 2; by JSC 17038, for Criticality 3; or by NSTS 21096, for non–critical hardware such as DSO/DTOs. A PMP is used to institute and establish definition/schedules for preliminary and CDRs, testing, certification/validation, acceptance, and delivery. The flight certified hardware is delivered to support events, such as, each mission stowage bench review, the CEIT and the TCDT prior to flight, as required.

4.3.2 Contractor Furnished Equipment

The items supplied by the Shuttle prime contractor, which are the responsibility of the Flight Crew Support Division, are in categories of equipment, egress accommodations, stowage, mounting hardware, mid–deck payload provisions, and mobility aids. The provisions reflect the technical requirements of the Shuttle Program and subsequent CCBDs. A subsystem engineer technically directs the contractor in the process of delivery of flight certified equipment. The equipment design and operation is validated in government mockup/trainer facilities and in the flight vehicle integration and countdown tests, as required. Vehicle installation procedures are documented by the OMRSD, Technical Orders, and the CCCD.

4.3.3 Configuration Documentation

Configuration documents for the direction of crew compartment stowage/installation of flight manifested equipment, food provisioning/stowage, electrical equipment power plug–in plan, and photographic equipment identification, lens focal settings, film, and stowage. These documents reflect the program CCBD/flight effectivity. These documents are utilized in the construction and selection of stowage provisions by the JSC Flight Equipment Processing Contractor (FEPC) and payload suppliers. The CCCD identifies equipment by nomenclature, part number, quantity, and illustrates stowage method/location. Vehicle equipment orientation and stowage in the crew compartment is directed by the CCCD.

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4.3.4 Certification

A certification of FCE and documentation is provided at the EVA/FCE, Space Shuttle Vehicle Engineering and SLSD FRRs.

4.4 RADIATION

Radiation analysis and dosimetry support is provided by the Earth Science and Solar System Exploration Division, Space Radiation Analysis Group (SRAG) and Radiation Dosimetry Laboratory (RDL). Products provided by this organization are the Shuttle ionizing radiation dosimetry hardware, preflight crew radiation exposure assessment, EVA crew radiation exposure assessment, onboard radioactivity assessment/reporting and flight rules update.

4.4.1 Shuttle Radiation Dosimetry Hardware

Radiation dosimetry hardware consist of Crew Passive Dosimeters (CPDs), Passive Radiation Dosimeters (PRDs), Area Passive Dosimeters (APDs), and radiation dosimeter assembly. These dosimeters are provided as crew equipment to meet the operational, medical and regulatory radiation measurement requirements for manned space flight. Dosimeter assembly begins 30 days before flight with delivery to the FEPC 10 days before flight. Drawings, certification documentation, and detailed laboratory assembly/processing procedures are maintained by the RDL. The current Shuttle radiation dosimetry complement materials/configuration was certified for 100 flights prior to STS–26. Shuttle dosimetry requirements are reviewed and implemented by the JSC MD 1152.9A. All radiation dosimeters are assembled by TPS according to internal documents SN3–R51, Final Assembly Procedures for the Passive Radiation Dosimeter (PRD) P/N SED 33102690–301; SN3–R52, Final Assembly Procedures for the Crew Passive Dosimeter (CPD) P/N SED 11100212–301 and SN3–R53, Final Assembly Procedures for the Radiation Dosimeter Assembly P/N SED 33103036–301 with the quality assurance organization predetermined Mandatory Inspection Points (MIPs). A CoFR is provided at the EVA/FCE and SLSD FRR.

4.4.2 Crew Radiation Exposure Assessment

The preflight crew radiation exposure is provided to the Medical Sciences Division in compliance with medical and regulatory requirements for flight crew preflight appraisal of projected radiation hazards and associated health risk. Space flight crew radiation exposure limits are listed in NSTS 07700, Volume X, Space Shuttle Flight and Ground System Specification. Exposure projections are obtained by analytical process with inputs from the final flight plan and trajectory data, analytical models of spacecraft structure for shielding, analytical anatomical models, analytical models of the natural space radiation environments, nuclear particle transport algorithms and biological dose equivalent computation techniques.

4.4.3 EVA Crew Radiation Exposure Assessment

The preflight EVA crew radiation exposure is provided to the Medical Science Division and the Flight Directors Office for compliance with the EVA planning groundrules and constraints for maintaining additional exposures during EVA As Low Below the Limits as is Reasonably Achievable (ALARA). This product is obtained by analytical process similar to that described above using EVA timeline and EMU model inputs.

4.4.4 Onboard Radioactivity Assessment

An assessment of onboard radioactive materials and radiation generating equipment to be flown on Space Shuttle is reported through NASA Headquarters Safety Division to the Office of Science and Technology Policy, Office of the President for launch approval. The JSC Radiation Constraints Panel is responsible for review, approval and reporting these radioactive sources to NASA Headquarters quarterly.

4.4.5 Flight Rules Update

Ionizing radiation flight rules are periodically reviewed and updated. Changes/ updates are submitted to the Flight Directors Office as required.

4.5 EARTH OBSERVATION

Earth observation support is provided by the Earth Science and Solar System Exploration Division, Earth Science Branch. Products provided for earth observation support include maps, Atlas, and a Mission Elapsed Time (MET) list.

4.5.1 Maps

Maps containing sites selected by the mission lead are plotted on a 1:52,000,000 scale mercated projection. These maps are provided to the FDF Office at L–5 weeks. The FDF mounts these maps on a slider board.

4.5.2 Atlas

Atlases are generated from a printed list of the sites along with their textual location description and coordinate definition. The textual list and map are used to mark two Atlases with black marker. The sites are defined as polygons. For sites defined as points, adhesive transparencies with circles printed on them with a laser printer are used. The atlases are provided to the FDF Office at L–5 weeks.

4.5.3 Mission Elapsed Time List

The MET list is generated by converting vector data provided by RSOC into a binary format and adding lift–off date and time into an AMPS computer propagator program. Orbits are propagated using the AMPS Program to produce data for every 30 seconds of the mission. Another computer program compares the propagated vector data with the defined sites to produce a list of site encounters. Other programs are run to format the data and produce the “next orbits” and “F–stop” data taking into account albedo and sun elevation. The MET list is given to FDF Office at L–10 days

4.5.4 Special Products and Crew Training

Others products such as manuals, books, and custom maps are provided to the crew upon request. The training manual with site descriptions are sometimes flown as part of the FDF. A customized reference book containing annotated maps and photos is provided for the crew upon request. Orbital track maps can be plotted and provided upon request. All special products to be flown are delivered to the FDA Office at L–5 weeks. All products generated are used in training the flight crew.

4.6 ORBITAL DEBRIS AND METEOR RISK ASSESSMENT

The orbital debris and meteor risk assessments are provided by the Earth Science and Solar Exploration Division, Space Science Branch. Products provided by this organiza–tion include the orbital debris collision hazard assessment, meteor shower/storm assessment, orbital penetration risk assessment and impact damage/repair assessment.

4.6.1 Orbital Debris Collision Hazard Assessment

The orbital debris environment is dynamic and any on–orbit fragmentation may signifi–cantly alter the environmental hazard. Maneuver rates are estimated by computing the flux of 10 cm and larger objects at or around the nominal mission altitude against a 2x2x5 km semi–axis ellipsoid centered on the Orbiter Vehicle. Population catalogs are updated three times a week and notification of on–orbit fragmentations are usually received within 24 hours of the event. If an event occurs during a mission, the Space Science Branch will provide an early assessment of the potential hazard to the Orbiter.

4.6.2 Meteor Shower/Storm Assessment

Meteor shower rates are also dynamic. Meteor showers are modeled using techniques described in NASA SP–8013, Meteoroid Environment Model (Near Earth to Lunar Surface). Impact rates for meteoroid sizes between 1 micron and 10 cm are deter–mined based on sporadic and stream meteor contributions. Advance warning of potential meteor storms is assessed and provided at the Space Shuttle Vehicle Engineering and SLSD FRRs.

4.6.3 Orbiter Penetration Risk Assessment

The BUMPER code is used to calculate Meteoroid and Orbital Debris (M/OD) penetration probabilities for critical Orbiter systems using mission altitude/attitude timelines and a detailed finite element model description of the Orbiter and payloads. Detailed Finite Element Models (FEMs) of the Orbiter and payloads are created using IDEAS software. The FEMs are inputs to the BUMPER code and used to predict M/OD impact and penetration probability. This assessment is provided at the Space Shuttle Vehicle Engineering and SLSD FRRs.

4.6.4 Impact Damage/Repair Assessment

The BUMPER penetration assessments are extended to predictions of impact damage to Orbiter surfaces and systems such as the crew module windows, radiator panels, and Reinforced Carbon–Carbon (RCC) wing leading edge. Orbiter attitude strongly influences the expected damage rate to these surfaces and resulting costs of repair. This assessment is provided at the Space Shuttle Vehicle Engineering and SLSD FRRs.

5.0 SLSD FLIGHT READINESS REVIEW (FRR)

A SLSD FRR is successfully completed which reviews processes and products for completeness. The SLSD FRR is designed to meet, as a minimum, the CoFR requirements specified in Paragraph 8.5.15.1. The SLSD FRR is chaired by the SLSD Director/Deputy Director. Each division or office manager/representative attends and reviews data presented by responsible areas which demonstrates that the requirements stated in the SLSD Flight Preparation Plan are met. The completion of the SLSD FRR is each responsible organization signing the CoFR statement.

APPENDIX P

FERRY OPERATIONS
FLIGHT PREPARATION PROCESS PLAN

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FIGURES

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APPENDIX P

FERRY OPERATIONS
FLIGHT PREPARATION PROCESS PLAN

1.0 FERRY PLANNING READINESS REVIEW

The Ferry Planning Readiness Review is conducted to verify that adequate planning and coordination has been accomplished to assure safety and mission success. The review will be conducted approximately one week prior to the FRR and will ensure the Shuttle Carrier Aircraft (SCA), Pathfinder aircraft, and mating equipment will be ready to support the Orbiter ferry operation after the Orbiter has landed. Additionally, the configuration of the Orbiter for End of Mission (EOM) ferry and the plans and support provisions for the ferry operation from the EOM landing site will be reviewed. The general planning for a TAL ferry will also be reviewed.

2.0 RESPONSIBILITIES

The assigned Ferry Manager is responsible for conducting the Ferry Planning Readiness Review. Further, this responsibility includes planning, coordinating, and implementing the Ferry Planning Readiness Review requirements and agenda; tracking, coordinating, statusing, ensuring closeout of exception items, and preparation of the Ferry Operations Readiness Statement for the FRR.

3.0 ORGANIZATION

The Ferry Planning Readiness Review Board will be chaired by the assigned Ferry Manager and as such will be solely responsible for the decision that planning readiness for ferry is adequate. The board will include as members:

a. Ferry Manager

b. Shuttle Processing Representative, KSC

c. Flight Crew Operations Directorate (FCOD) Mission Coordinator

d. Space Shuttle Vehicle Engineering Representative

e. Space Shuttle KSC Integration Office Representative

f. Space Shuttle Customer and Flight Integration Office Representative, JSC

g. Department of Defense Manned Space Flight Support Office (DDMS) Representative

h. Space Flight Operations Contractor Representative

i. Space Shuttle SR&QA Representative

4.0 REVIEW REQUIREMENTS

a. Presentation Emphasis: The Ferry Planning Readiness Review will cover readiness of the SCA, projected EOM Orbiter mass properties and configuration, predicted performance, planned ferry route and stop–over points, support requirements, and payload considerations.

b. Schedule: The Ferry Planning Readiness Review will be held approximately one week prior to the FRR.

c. Location: The Ferry Planning Readiness Review will be conducted at JSC and teleconed to other sites as required.

d. In support of the Ferry Planning Readiness Review, the projects/organizations shall ensure accomplishment as applicable and present a status summary of the following items:

   1. Ferry flight hardware (attach hardware, ferry plugs, tailcone) status
   2. Landing site turnaround operations plan and schedule
   3. KSC ground operations
   4. Proposed flight plan
   5. SCA readiness status
   6. Projected ferry mass properties for Orbiter
   7. Orbiter constraints to ferry
   8. Unique payload ferry requirements
   9. Readiness of enroute airfields to support

e. Agenda items and presenting organizations:

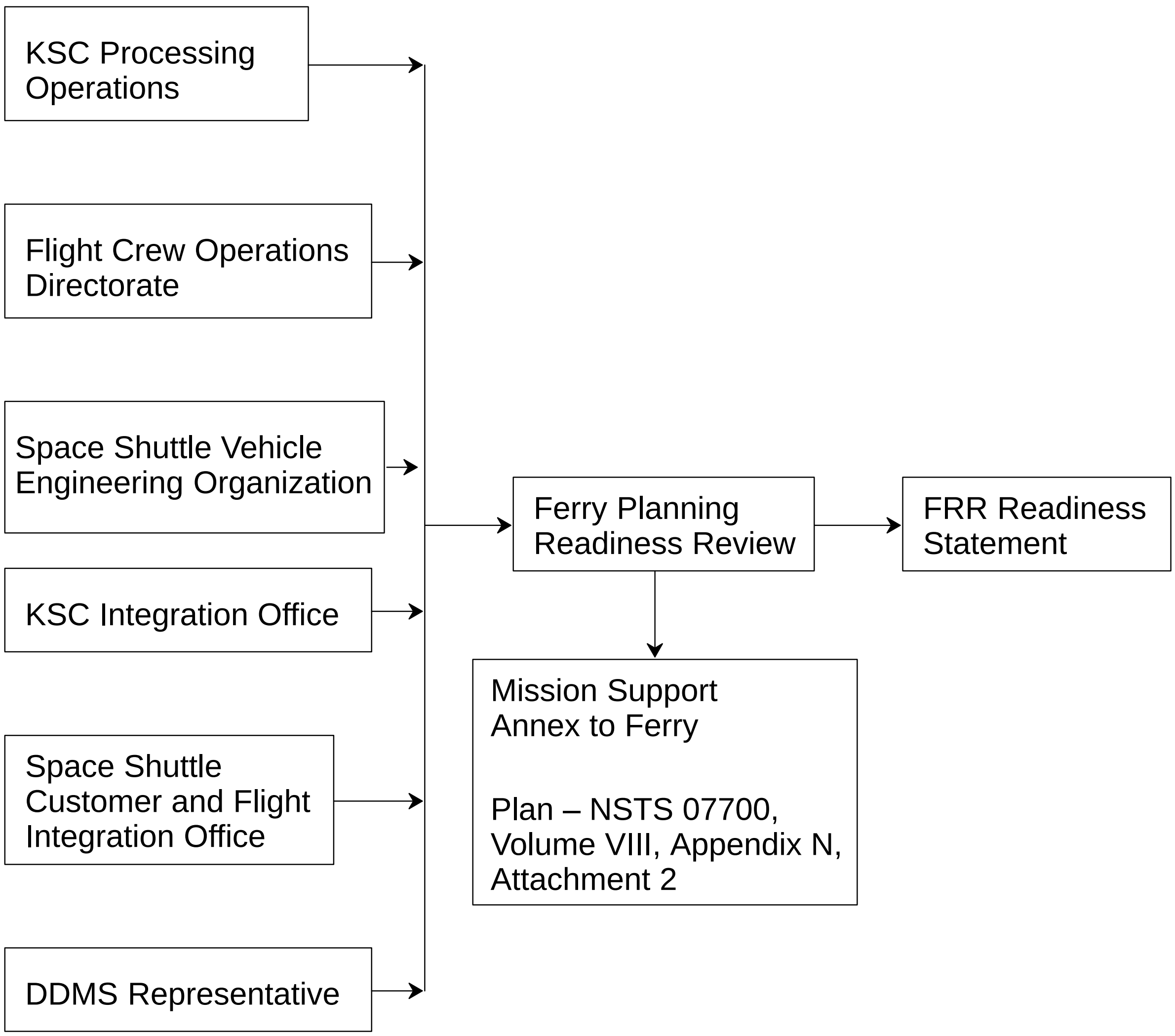
1.	Introduction	Ferry Manager
2.	Mate–Demate Operations	Shuttle Processing, KSC APM, Ground Operations, SFOC
3.	KSC Integration	Space Shuttle KSC Integration, KSC APM, Program Integration, SFOC
4.	Orbiter Vehicle Engineering	Space Shuttle Vehicle Engineering, JSC APM, Hardware/Software, SFOC

5.	Payload Integration	Space Shuttle Customer and Flight Integration, JSC
6.	Airfield Readiness	DDMS, JSC
7.	Flight Operations	Aircraft Operations, JSC
8.	Action Item Summary	Ferry Manager
9.	Readiness Discussion	Ferry Manager

f. After the Ferry Planning Readiness Review, the NSTS 07700, Volume VIII, Appendix N, Attachment 2, Mission Support Annex to the Ferry Plan is produced utilizing the information presented during the review. The Mission Support Annex to the Ferry Plan is distributed to the appropriate ferry flight implementing and supporting organizations of the SSP. The Ferry Operations charts and Readiness Statement are prepared and transmitted to KSC for the FRR.

FIGURE P–1

FERRY PLANNING READINESS REVIEW



APPENDIX Q

SPACE SHUTTLE SAFETY, RELIABILITY, AND QUALITY ASSURANCE FLIGHT PREPARATION PROCESS PLAN

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APPENDIX Q

SPACE SHUTTLE SAFETY, RELIABILITY, AND QUALITY ASSURANCE FLIGHT PREPARATION PROCESS PLAN

1.0 PURPOSE

This appendix describes the elements that Safety, Reliability, and Quality Assurance (SR&QA) reviews in preparation for flight. Details on the SR&QA process are contained in NSTS 22778, Commit–to–Flight Assessment Review Process Operating Plan.

2.0 SCOPE

This appendix applies to all of the work that SR&QA does at JSC, MSFC, and KSC in preparation for flight. The SR&QA Organization at each location is responsible for different parts of the total assessment of flight readiness. The next three paragraphs describe the general areas of responsibility at each location.

JSC SR&QA is responsible for Space Shuttle Program SR&QA, Orbiter SR&QA, JSC Payloads SR&QA, and EVA Project SR&QA.

MSFC S&MA is responsible for SSME S&MA, SRB S&MA, RSRM S&MA, ET S&MA, and MSFC Payloads S&MA.

KSC Shuttle S&MA is responsible for Shuttle Processing S&MA, Logistics S&MA, S&MA on the processing of flight hardware, and S&MA on ground system hardware. ISS/Payloads Processing S&MA is responsible for KSC Payloads S&MA.

3.0 SR&QA FLIGHT PREPARATION PROCESS

3.1 HAZARD ANALYSIS

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA review all hazard changes that were effected by new hardware or procedures, or that represent an increase in risk classification to the projects or program applicable to this flight. The results of the reviews are presented to the Systems Safety Review Panel (SSRP), Project Configuration Control Board, and the Prelaunch Assessment Review (PAR) as appropriate. The remaining hazard changes are audited to ensure that they do not represent an increase in risk classification.

3.2 LAUNCH COMMIT CRITERIA

JSC SR&QA, MSFC S&MA, KSC Shuttle S&MA review all LCC changes that represent an increase in risk classification to the program. The remaining LCC changes are audited to ensure that they do not represent an increase in risk classification. Significant issues are reviewed in the PAR.

3.3 NASA SAFETY REPORTING SYSTEM (NSRS)

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA coordinate resolution of all NSRS reports applicable to this flight with the organization most responsible for the area that is reported. Closure of the NSRS is reported to NASA Headquarters Office of Safety and Mission Assurance.

3.4 FLIGHT RULES AND CREW PROCEDURES

JSC SR&QA and MSFC S&MA review all flight rule and crew procedure changes that represent an increase in risk classification to the program through a representative on the Flight Rules Control Board (FRCB) and the Crew Procedures Control Board (CPCB). The remaining changes are audited to ensure that they do not represent an increase in risk classification. Significant issues are reviewed in the PAR.

3.5 SOFTWARE

JSC SR&QA and MSFC S&MA review all software problems to ensure that the resolution is acceptable for flight. JSC SR&QA audits flight software requirements definition in released engineering and flight software verification. JSC SR&QA is a voting member of the SASCB. MSFC S&MA reviews and approves all changes to the SSME Controller test and flight software. KSC Shuttle S&MA audits GSE and L&L facility certification.

3.6 FAILURE MODES AND EFFECTS ANALYSIS/CRITICAL ITEMS LIST

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA review all FMEA/CIL changes that represent an increase in risk classification to the projects or program applicable to this flight. The results of the reviews are presented to Project CCB, PRCB, and the PAR as appropriate. The remaining FMEA/CIL changes are audited to ensure that they do not represent an increase in risk classification.

3.7 ALERTS

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA ensure that all ALERTs applicable to this flight are properly dispositioned.

3.8 HARDWARE PROBLEMS AND IN–FLIGHT ANOMALIES

JSC SR&QA and MSFC S&MA review all IFAs and PRACA reportable problems to ensure that the resolution is acceptable for flight. KSC Shuttle S&MA audits IFAs and PRACA reportable problems.

3.9 WAIVERS AND DEVIATIONS

JSC SR&QA and MSFC S&MA review all waivers and deviations to ensure that the resolution is acceptable for flight. KSC Shuttle S&MA audits waivers and deviations.

3.10 OPERATIONS AND MAINTENANCE REQUIREMENTS AND SPECIFICATIONS DOCUMENT

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA reviews OMRSD changes that represent an increase in risk classification to the program. The remaining OMRSD changes are audited to ensure that they do not represent an increase in risk classification.

3.11 LIMITED LIFE

JSC SR&QA and MSFC S&MA audits flight hardware records to determine if hardware is within time, cycle, age life, interval inspection, and maintenance requirements.

3.12 CERTIFICATION

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA audits certification records for hardware and software. MSFC S&MA reviews and approves Certificates of Qualification.

3.13 SIGNIFICANT NON–CONFORMING PARTS AND MATERIALS

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA approves all NASA participation MRB items and identifies open issues or potential constraints resulting from non–conforming parts and materials. Contractor only MRB review is accomplished through surveillance.

3.14 UNEXPLAINED ANOMALIES (UAs)

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA reviews UAs that represent an increase in risk classification to the program. The remaining UAs are audited to ensure that they do not represent an increase in risk classification.

3.15 TRAINING

JSC SR&QA and KSC S&MA verifies that all NASA inspectors actively participating in this flight are properly trained. MSFC S&MA verifies the qualification/certification of inspectors who process MSFC hardware via periodic audits.

3.16 RESTRICTED USE HARDWARE

JSC SR&QA, MSFC S&MA, and KSC Shuttle S&MA audits restricted use hardware to ensure that the resolution is acceptable for flight.

3.17 INDEPENDENT ASSESSMENT

HEDS Independent Assessment (includes JSC and MSFC), and KSC Safety, Health, and Independent Assessment conduct independent assessments of selected program and project activities to determine process stability, acceptability of flight hardware and software, and readiness for flight.

APPENDIX R

SPACE FLIGHT OPERATIONS CONTRACTOR FLIGHT PREPARATION PROCESS PLAN

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APPENDIX R

SPACE FLIGHT OPERATIONS CONTRACTOR FLIGHT PREPARATION PROCESS PLAN

1.0 INTRODUCTION

1.1 PURPOSE

The Space Flight Operations Contractor (SFOC) FPPP defines the processes and products the SFOC certifies in support of the Space Shuttle Program Certification of Flight Readiness.

1.2 SCOPE

This appendix describes the processes and associated products SFOC is responsible to develop, review, and certify for flight.

2.0 RESPONSIBILITIES

The following sections describe the processes and products SFOC is responsible for developing. It also includes the processes in which SFOC participates, in order to ensure the readiness for flight. Additionally, the individual PDPs and SFOC–specific FPPPs describe details of methods and procedures for satisfying the requirements for CoFR. These include the following:

a. PDP MS8–005, Program Integration Certification of Flight Readiness Product Development Plan

b. PDP 3.2–MV–FRR, Orbiter Flight Readiness

c. PDP 6.8–MV–FSW FRR, Flight Software Flight Readiness (Preliminary)

d. SFOC–96–055, SFOC Ground Operations Flight Preparation Process Plan

e. SFOC–FLO–389, SFOC/Flight Operations CoFR/Flight Preparation Process Plan

f. SFOC–PA–0007, Safety and Mission Assurance Flight Preparation Process Plan

g. PDP MS3–013, Space Shuttle Program Systems ICDs Product Development Plan

3.0 SPACE SHUTTLE VEHICLE HARDWARE/SOFTWARE PROCESSING

3.1 FLIGHT ELEMENT PROCESSING

All flight and ground element processing activities have been performed in accordance with approved work authorization documents.

Flight element processing consists of all testing and maintenance (planned and unplanned) required to verify flight element system condition and performance is within specified limits and to ready the flight element for integrated processing in preparation for launch. Integrated processing consists of all testing and maintenance required to bring the flight elements together ready for launch. These tasks shall include as a minimum SRB/RSRM stacking operations in the VAB, ET mate to the SRBs, Orbiter to ET mate, SSV transport and mate to the launch pad, launch pad interface testing, hypergolic propellant servicing, ordnance installation, EMU installation/servicing/checkout, and Orbiter aft compartment close–outs. The transition from integrated processing to flight element processing is at the last operation after element de–integration (e.g., Orbiter wheel stop in the OPF or Mate–Demate Device (MDD) at DFRC, SRB/RSRM ready for shipment after disassembly).

To assure these activities are performed within programmatic guidelines, all requirements are implemented in work authorization documents. These documents are used to assure all flight element processing activities are performed in accordance with approved requirements to assure these elements operate within all the design specifications, drawings, and OMRS; all turnaround processing activities associated with preparation of the Orbiter for flight, including special action requirements and support for integrated operations have been performed per specifications; launch preparation and post–launch activities related to the overall processing of equipment required to support the SSP has been provided and processed using proper specifications and authorized documentation; and software utilized to support checkout and processing of flight elements and mission unique application software development has been completed and is ready to support element processing. Systems, facilities, and equipment have been maintained, managed, and operated according to approved requirements and documentation. Additionally, the processing required to prepare the Orbiter to accept payloads is completed. Subsequently, element/cargo operations associated with vehicle/payload integration, including element readiness reviews, requirement completion status, and open or transferred work assessments are planned and integrated. Horizontal and vertical payload element installation into the Orbiter is performed per authorized documentation.

The Orbiter processing activities associated with preparation of the Orbiter for flight, including support for integrated operations are performed.

Products: All plans, procedures, and processing activities are compliant with appropriate requirements and policies and have been baselined in controlled documents; Logistics Performance Reports; Special Action Requirements (SARs); and OMRSD changes.

3.2 FLIGHT SOFTWARE

Flight software has been developed per released requirements, verified and implemented to support the mission.

Individual software packages and integrated software systems necessary to provide for avionics FSW development, certification, reconfiguration, testing, and verification in accordance with the current baseline process have been developed and maintained. All FSW application tools unique to the development, reconfiguration, and maintenance of the Shuttle onboard PASS and BFS FSW have been developed and maintained. Configuration control of all FSW products delivered to NASA has been maintained with full traceability to NASA approved requirements to the individual items delivered and applied to each OI of Shuttle build.

Processing pre–installation has been performed and a total or partial load is installed. Memory dumps and compares to ensure proper installation is performed. Also included are assessments of the software delivery to determine any GOAL application/procedure impacts and test support and procedure execution has been provided.

Flight software change requirements for the STS missions and pre– and post–launch ground checkout have been established. FSW change proposals and change requests have been provided to the SASCB. SASCB responses to FSW changes proposed by Software Change Request (SCR), DCR, FSW DRs, or SSME SANs have been assessed and comply with current baseline software processes. The payload and vehicle requirements needed to reconfigure the appropriate software for Shuttle vehicle and ground facilities in support of the SSP mission have been developed. In developing these requirements, the payload suppliers and the Shuttle community have been consulted and the requirements have been identified to perform flight–specific data reconfiguration.

PASS and BFS FSW for on–board space systems, including the data processing system of the Orbiter have been produced. Requirements have been approved prior to implementation in all software resident in the Orbiter avionics onboard computers. Implementation of the software is accomplished by OI source code deliveries, source code changes to flight systems, or as address patches to flight systems. After the completion of the First Article Configuration Inspection an additional and independent verification of all FSW and flight software application tools developed is validated and verified to be within requirement. Verification includes analysis of computer performance, predication, and measurement.

From pre–launch through all flight phases to vehicle powerdown on the runway the flight support team, under direction of the NASA team lead, is prepared to provide technical consultation concerning flight software related issues and to perform analysis, data collection, and resolve anomalies encountered.

POC computer system flight software file loads and associated integration/training have been provided. This includes development and maintenance of the POC applications software and associated documentation.

Any GFE software identified to support the flight software load with each new release is updated.

Launch site services for the FDF have been provided. FDF/Operations Data File (ODF) services include development of documentation for the CPCB, Operations Data File Control Board, and POCA. Crew procedures management documentation is developed and maintained.

Products: All products as required by the Class 1 Integration Plan, the MMU Integration Plan, and the Reconfiguration Performance Test Plan. All products required by the SFOC contract including PASS and BFS Requirements Documents and Interface Control Documents, Integrated Avionics Verification Test Requirements Document, and Integrated Avionics Verification Test and Analysis Report. Software Readiness Review briefings, flight readiness statements, and Integrated Avionics readiness statement.

3.3 HARDWARE CERTIFICATION

All necessary hardware has been certified and delivered to support the mission and is within the time, age, and life cycle requirements.

Certified and validated ground facilities, systems, equipment, and applications software have been provided.

Certified mission–specific cargo integration hardware for cargo bay and crew compartment reconfiguration have been delivered. Hardware items procured from suppliers have been certified. Repaired hardware is certified to conform to specifications and flight hardware have been maintained per certification requirements.

Orbiter hardware, embedded software, and system modifications including engineering drawings and associated lists, hardware and embedded software installation instructions, and verification and certification requirements have been developed, produced and certified. Orbiter hardware mission kits have been produced, developed, certified, and delivered. Repairable and nonrepairable hardware required for Orbiter processing and flight have been certified and delivered.

Hardware provided to Orbiter or other program elements by Integrated Logistics has been processed (manufactured or repaired) to approved engineering drawings and specifications. Nonconformance to drawings or specifications have been accepted by appropriate Material Review action or project/program waiver. This process assures that hardware provided by the Integrated Logistics Element remains certified to the hardware design elements requirements. Having met these requirements, the hardware is certified for flight. Logistics will support Element reviews and will identify any unresolved issues requiring attention in the CoFR process.

Certified standard flight design products resulting in a basic flight trajectory and consumables profile that meets the requirements of the SSP and International Space Station Program (ISSP) have been delivered. This includes all associated mission–specific analysis and integration activities. These products are delivered via a flight design reconfiguration management process that requires appropriate levels of quality assurance.

Specific products and processes to support certification of hardware developed by SFOC Program Integration are defined in PDP MS3–004, Cargo Hardware Design and Development.

Products: ADPs; Flight Design Reconfiguration Management Process Plan; Specification Change Notices; Materials Analysis, Tracking and Control Information and Data System; Certification Approval Request (CAR)/Qualification Site CAR; Requirement Definition Documents for Modifications, Mission Kits and GSE, and Equipment Inventory Report.

3.4 PERSONNEL CERTIFICATION

All personnel actively participating are trained and/or certified.

MOD, flight crew, launch support, ferry readiness, processing, testing and checkout training where identified has been provided and meets certification standards. All personnel required to support the above processes have attended the required training and are certified.

Training of government and contractor personnel (as required) is provided for all personnel who participate in the operations or work areas. This includes SSP and ISS crew training and flight controller training and associated processes, management and documentation of the training processes utilized in the production of all flight specific and generic training products in accordance with the Training Development and Support Plan.

Personnel participating in ground processing operations and work areas have been trained and certified. Launch team personnel are trained, qualified and certified for launch countdown and flight crew pad emergency egress. Training services and products include training procedures and materials, tanking and Launch Simulations, and Terminal Countdown Demonstration Tests.

Training includes execution of the overall training processes to assure flight crews and controllers are prepared to carry out their assigned flight tasks. Training requirements based on SSP and ISS manifests and vehicle configurations are established and implemented. An agreement with payload customers that defines scope and assigns responsibility for SSP Payload training is established and has been implemented. Training and certification records have been maintained in support of Flight Controller Certification, Mission Controller Certification, and Crew Readiness. The SSP Flight Controller and the ISS Mission Controller Certification Guides for positions are developed and maintained. JSC 22359, SSP Crew Training and the ISS Crew Certification Guide is developed and maintained.

Products: Mission Controller Certification Guide; The SSP Crew Training Certification Guide; KSC Launch Team Certification Plan; Training/Certification Plan and Schedule Report; Annex 7 (Training) – Payload Integration Plan; Flight Operations Training Records; Flight or Increment Specified Crew Training Plan; Flight Crew Products Handbook and Product Glossary; and Flight Console Support Plan.

3.5 LAUNCH PREPARATION

All launch preparation tasks are completed in support of launch.

Integrated launch procedures have been developed and maintained in accordance with approved documentation. Work control functions such as launch procedures, plans, and schedules development; and distribution of these to the users for launch execution has been provided. The NASA Countdown Working Group has been supported in efforts to define and resolve specific countdown issues. The launch team has been trained; qualified and certified to perform launch countdown operations, and provide flight crew pad emergency egress training. L&L readiness has been reviewed through open item reviews, pre–test briefings, facility/equipment/flight element readiness walkdowns, closed–loop tracking, verification and satisfaction of configuration, OMRS and Program Verification Information System/Assembly Checkout Operations Maintenance Configuration requirements.

Activities required to ensure and verify launch operations include verification of final launch readiness, requirement satisfaction, and problem resolution; complete remaining vehicle/payload/ISS/pad close–out activities, support PGOC in Payload/ISS/pad/close–out activities, and conduct launch countdown with a certified and qualified launch control team. Launch countdown activities include as a minimum integrated propulsion system integrity verification, final facility/pad/equipment/flight element walkdowns, reactant servicing, rotating service structure securing, late access/conditioned cargo installation activities, flight crew equipment stowage, flight crew support, ET loading, flight crew ingress and cabin close–out, terminal count, launch and initial pad safing/securing in accordance with OMRS and LCC requirements.

Products: KSC Ground Launch Sequencer Configuration Plan and Data Reconfiguration Deliverables.

3.6 FLIGHT/MISSION EXECUTION PREPARATION

Requirements are identified, products are delivered, and preparations have been completed for flight/mission execution.

This includes preparation of flight products and services including flight rules/operations documentation/flight data file, flight design, flight planning, payload integration, flight crew integration, data collection and reconfiguration.

Management and execution of the overall flight design processes for operations for the SSP and ISSP includes the following processes; flight design requirements development, flight design products generation, flight design post–flight reconstruction, flight design process integrity data generation, and flight design software sustaining engineering. Included in the flight design requirements development is the definition and implementation of the requirements to meet the NASA defined mission–specific requirements.

Preparation of flight execution includes vehicle design and operations integration with respect to flight design, requirements development for selected flight control/training tools and facilities, requirements for operations application software development, user verification and checkout of selected application software, development and review of flight selected operations console procedures. Flight design related to Orbiter consumables analysis (propulsive and non–propulsive), thermal analysis, robotics software maintenance and analysis in support of multi–program flight design, ISS resource analysis, and ISS electrical power analysis have been performed.

Flight planning requirements development and generation/maintenance of all generic planning data bases, flight–specific planning data bases and increment planning data bases (ISS) have been prepared. The altitude timeline is generated and development of pointing procedures/techniques and pointing data is completed.

Critical functions required to support flight operations in the MCC have been maintained. This includes maintenance of all hardware and software, custom and COTS, required to provide command and control capabilities for mission operations in support of the SSP and ISSP.

Contract accountable Flight Control Team support functions to accomplish vehicle and flight systems operations, flight planning, payloads, assembly operations, and flight design and dynamics operations as required to assure safety and mission success.

Products: Orbiter Payload Bay and Mission Kit Configuration Data; Master Measurement Lists; Instrumentation Program and Components Lists; Flight Operations Management and Integration Plan; FDF/ODF; Flight Crew Equipment Management Plan; Data Reconfiguration Deliverables; and Flight Controller Mission Support Plan and Status.

3.7 FCE AND EVA PROCESSING

The following SFOC processes related to specific requirements are followed for preparing hardware for flight:

a. **Requirement** – Problems, explained anomalies, and IFAs have been evaluated and documented as acceptable for flight readiness.

   The process assures that all manifested hardware is successfully processed to approved procedures and specifications. Once this is completed, a JSC Form 1027 is initiated that starts the review process for any open paper (TPSs, DRs, FIARs, certification, and hazards) on this hardware. If found, it is addressed and closed or dispositioned as no constraint to flight with the appropriate signatures. Once this is completed, the JSC Form 1027 is routed for approval, and the hardware is made available for shipment.

   For in–flight anomalies, the first action taken is to document the discrepant hardware by part number and serial number on a DR. When the hardware is retrieved post–landing, it is tested for validity of the discrepant condition identified. If validated, a FIAR is then generated and resolved through the PRACA System.

b. **Requirement** – Safety analysis/reports have been completed, identified hazards are closed, CIL retention rationale accepted, and ALERTs have been reviewed and are not a constraint to flight readiness.

   A CCB CR identifies organizational responsibility for development of the safety analysis reports and hazard reports.

   The NASA Safety Division or their representative determines what type of analysis needs to be completed. In the Actions Block of the CR, the analysis is assigned to an organization. If SFOC is assigned an action, the required documentation and analysis is submitted for approval as applicable to:

   1. NASA Safety Division

2. Manufacturing, Materials, and Process Technology Division

3. Structures and Mechanics Division

For ALERTs, the NASA Reliability Division provides ALERTs to SFOC. SFOC in turn identifies if any of the affected lot is in bonded storage and if any of this lot has been placed into flight hardware. Any items found are identified on a DR and segregated.

c. **Requirement** – All equipment defined in the CCCD crew compartment drawing, plus DCNs, the Mission Equipment Cargo Support Launch Site Installation Drawing and/or the crew equipment list that one is responsible for has been processed for flight by approved procedures which include the equipment by locker and installation location.

SFOC develops a MUPP–Document No. D528–101XX–X for each STS mission) based on the CCCD and all applicable DCNs. Hardware for each mission is then processed based on approved procedures identified in this MUPP. Final locker packing operations are conducted per the CCCD and the BARS–04 Report. This comparison serves as a cross reference check prior to shipment of the hardware to KSC.

SFOC utilizes the Mission Equipment Cargo Support Launch Site Installation Drawing data at KSC to extract pertinent information in processing the Closed Circuit Television (CCTV) systems.

d. **Requirement** – All equipment changes approved by the FCE CCB were incorporated.

The SFOC process assures that equipment changes resulting from CCBDs result in DCNs to the CCCD. All DCNs are incorporated in the SFOC_MUPP, and hardware is then processed based on this document.

e. **Requirement** – All changes or deviations to critical processes in equipment preparation have been reported.

All hardware has procedures for processing. If there is a deviation from the procedures, then a Procedure Deviation (PD) is requested. Any changes to critical processing are brought to the attention of the NASA subsystem manager and reported during the FRR.

Products: BARS–04 Report, JSC Form 1027, Food Drawing, Stowed Clothing Drawing, EMU Flight Data Books, EMU stowage list, JSC 24397, Payload Equipment Landing Site Disposition Manual and Mission Unique Delay Document.

3.8 SRB ELEMENT

This section sets forth the manner in which SFOC and its subcontractor, USBI, will perform SRB element flight preparation process, to assure compliance with all areas of this document.

This section also defines the activities which will be undertaken to ensure that the SRB is compatible, that traceability exists between requirements and analyses, that management visibility exists relative to significant trends in critical SRB systems, and that a team approach to readiness exists.

3.8.1 Flight Preparation Process

The SRB FPP includes analysis, hardware/system verification, and anomaly resolution. The process ultimately culminates in a NASA program–level FRR and the signing of a CoFR. The processes described herein have been developed to ensure Shuttle SRB system integrity over the life of the program.

The FPP embodies an accountability system which assures that all concerned disciplines have completed the work required to determine that there are no safety–of–flight issues and to assure that each mission will have the highest probability of success. The FPP assures that all pertinent requirements have been addressed.

The process begins with the LSRR, which provides status of transferring SRB hardware to the launch site and changes that affect the processing, and ends with the final commit–to–launch of the Space Shuttle Vehicle. The FPP includes an evaluation of the integrity and analyses of the SRB and its subsystems readiness for each mission and the processes leading to the determination that the hardware is ready to support the mission. The FPP involves various reviews and includes the preparation of Flight Readiness Statements at the Project EAR and the FRRs.

3.8.2 Areas of Responsibility

The SFOC SRB Element Office and USBI is tasked to assess specifically defined areas of responsibility for each SRB during the preparation of the vehicle for each mission.

The FPP and associated activities required to commit to a readiness milestone fall within the following categories:

a. Previous post–flight assessment

b. Changes since last flight set

c. Certification

d. Nonconformances/Criticality 1/1R test failures/anomalies since last flight set

e. SR&QA summary

f. Configuration summary

g. Technical issues/special topics

h. Open items/exceptions

i. Readiness assessment

3.8.3 Major Milestones Reviews

LSRR – SFOC and USBI's participation in this review assures the proper identification and definition of SRB modifications and other activities which must be accomplished during that flow. Activities include the identification of required engineering documentation and the hardware (including LRUs, modification kits, etc.) needed to support the SRB stacking and processing activities. It is during this review that specific/required nonstandard tasks and, Operations and Maintenance Requirements and Specifications Document (OMRSD), are identified.

Launch Site Flow Review (LSFR) – Participation by SFOC and USBI in this review assures that required hardware will be available and that it can be delivered in time to support work schedules. Changes approved since the LSRR are addressed and accommodated during this review. Particular attention is given to assuring that vehicle configuration is identified and control is maintained during the flow process.

Element Acceptance Milestone Review (SFOC/USBI) – Participation by SFOC and USBI management, supported by a review board, in a comprehensive review of all activities/elements necessary for the safe and successful conduct of all operation from SRB retrieval through refurbishment, build–up, test, launch, ascent and SRB separation results in an assessment of flight readiness of the SRB hardware configuration.

Delta Launch Site Review – SFOC and USBI actively participate in defining any additional effort associated with the impacts caused by in–flight anomalies, post–flight inspections, or refurbishment and manufacturing operations.

Project EAR – Participation in an integrated review by SFOC, USBI, and the MSFC SRB Project FRR Board assures that the as–designed, as–built, as–delivered SRB configuration is ready for launch site processing and can be certified as flight worthy.

ET/SRB Mate Milestone Review – SFOC and USBI actively participates to assure the SRB's readiness to support stacking operations. Review provides the status of SRB hardware, all Open Work and identifies any constraints for stacking of booster assemblies.

Preflight Readiness Review (SFOC/USBI) – This review highlights those significant items/issues, open action items or significant out–of–family conditions that have occurred since the SRB Project EAR and includes other significant items from the EAR. Significant items are designated for presentation at the SRB Project Pre–FRR.

Project Preflight Readiness Review (NASA/SFOC/USBI) – SFOC and USBI prepare and present relevant documentation and data at a NASA project–level Pre–FRR in depth to assure that flight hardware/software discrepancies, anomalies, and launch constraints have been fully evaluated and resolved.

SFOC Preflight Readiness – Based upon the acceptance of the documentation presented at the Project Pre–FRR, the primary topics of concern will be consolidated and presented to the SFOC Board. Upon completion of this review, selected subjects will be selected for presentation at the Program FRR.

Flight Readiness Review (FRR) – This review ensures the SRB FPP has been satisfactorily completed and all FRR certification requirements have been met. It also ensures all exceptions and launch constraints have been closed. SFOC/USBI will develop documentation in sufficient detail to provide the information needed to make a decision as to flight readiness of the SRB.

Prelaunch Mission Management Team Review – SFOC/SRB and USBI participation in this review includes preparation and presentation of documentation including briefings (as required) covering the following subjects:

a. Closure status of any actions assigned at the FRR.

b. Resolution of any constraints to launch identified at the FRR.

c. Resolution of all problems and anomalies, including any identified as unresolved at the FRR and any encountered since the FRR.

d. Resolution and closure of all open items/work identified at the FRR.

e. Final verification of the as–built versus as–designed configuration of the vehicle.

Products: DD 1149 Form

4.0 REQUIREMENTS ANALYSIS AND DEFINITION

4.1 DRAWING AND PAYLOAD REQUIREMENTS

4.1.1 Drawing Requirements

The systems level drawings, cargo engineering drawings, and CCCD have been generated, distributed, and implemented to support launch according to NASA baseline requirements.

The Shuttle Systems Level Drawings (V072–000001), Ferry Configuration Drawing (V072–300055), CCCD, and MECSLSI (V072–200XXX) have been developed and maintained based on program direction. These drawings are required to configure the Orbiter vehicle for payload accommodations and to support operations for each Shuttle flight.

Specific FPP products and processes developed by SFOC Program Integration to meet drawing release requirements are defined in PDP MS3–002, Reconfiguration Engineering.

Products: MCPP; Space Shuttle Systems Drawings, Ferry Configuration Drawing, CCCD; Cargo Engineering Drawings; Schematics; and Technical Orders; and CRs releasing Systems Level drawings.

4.1.2 Payload Requirements

PIP Annex 1 has been completed.

Through interfacing with the payload customers, PIP Annex 1 has been developed, baselined, and maintained in accordance with the PIP schedule. In addition, the required MIPs annexes to support manifest ISS elements have been baselined and maintained to support launch.

Specific products and processes developed for the FPP by SFOC Program Integration in support of payload requirements are defined in SFOC Program Integration PDP MS3–008, Payload Data Package – Annex 1.

Products: Annex 1, Payload Data Package.

4.2 PROGRAM REQUIREMENTS

4.2.1 Program Requirements

All changes to program requirements (e.g., ICDs, OMRS, LCC, flight rules, crew procedures, and LPS software) including waivers, deviations, and exceptions have been reviewed, concurred on and implemented to support the launch.

Changes to the ICDs, OMRS, LCC and LPS software have been reviewed. When necessary changes have been identified, a technical review will be conducted and waivers/exceptions and issues resolved with the technical community. When required, changes have been presented to the NASA for approval and upon approval incorporated into the necessary documentation. All ICDs, OMRS, LCCs have been maintained in accordance with program documentation.

Payload unique requirements have been coordinated with the Shuttle users and developed, approved, published and maintained the ICDs, IRD, and associated drawings.

Exceedances outside the experience base and waivers or deviations outside the requirements of NSTS 07700, Volume XIV, NSTS 21000–IDD–ISS, NSTS 21000–IDD–MDK or NSTS 21000–IDD–SML have been presented to NASA for disposition.

All Payload OMRS requirements have been coordinated with the payload customer and test requirements to verify the payload interfaces with the Orbiter vehicle have been developed. These requirements have been presented to the OMRS Board for approval.

Integrated analysis of technical requirements, problems and issues has been provided. This effort includes, but is not limited to ICD, OMRS, LCC, integrated logistics, ground systems integration and LPS software requirements; PMRB, UA Board, daily PRCB agenda items and launch support.

Flight rules documentation, publication and change processing for all flight and flight–specific flight rules has been provided. This includes tracking and collecting of program requirement changes which are used to integrate and coordinate these changes with the flight rules. Documentation for Flight Rule Control Board, Flight Techniques Panels, Joint Operations Panels and other related forums has been provided. Technical evaluations of program changes which impact crew procedures, safety, or operations have been provided to the NASA through assessments and reports.

Specific products and processes developed by SFOC Program Integration to meet Program Requirements are defined in PDP MS3–001, Payload Engineering Products Shuttle to Payload Interface Requirements; PDP MS3–007, Payload Engineering Products – Payload Unique Interface Requirements; PDP MS3–009, Payload Engineering Products – OMRSD; PDP MS3–002, Reconfiguration Engineering; PDP MS8–003, KSC Requirements and Maintenance; PDP MS3–010, Payload Engineering Products – ICD Compatibility Assessments; and PDP MS3–013, Space Shuttle Program Systems ICDs.

Products: Element IRNs OMRSD Changes; PASS BFS Changes, Flight Rules Publication; LCC Publication; ICD Publication; Payload ICDs, IRDs, and OMRS Test Requirements.

4.2.2 Orbiter Requirements

Orbiter design changes are identified, reviewed, approved, certified, and implemented to support Orbiter processing.

Based on processing requirements and obsolescence Orbiter design changes are planned for each mission. Once these changes have been identified, impact assessments are performed. Based on the impact assessments, modification and mission kits are produced and the new requirements are supplied to the using site.

Products: Requirements definition documents for modifications, mission kits and GSE; Certification Requirements; and CAR Qualification Site CAR.

4.2.3 Mission Requirements

Mission configuration and other requirements are defined in the MRCS data base.

Program mission requirements including modification, manifest, and non–standard work are entered into the MRCS data base. Analysis of all modification, manifest, and non-standard work records is performed to identify interface compatibilities and missing/ incomplete tech orders. These items are flagged in MRCS until resolved. This process includes all flight elements, e.g., Orbiter, ET, SRB, RSRM, SSME, mission equipment, and Payload Integration hardware.

4.3 ASCENT FLIGHT DESIGN REQUIREMENTS

All ascent flight design requirements have been defined.

All analyses required to define generic and mission–specific ascent trajectory design criteria and constraints have been performed. Ascent flight design criteria and constraints based on vehicle performance, flight systems capability, manifest requirements, vehicle certification and launch probability have been defined. Analyses and documentation required to periodically update the generic MPS inventory/budget in response to systems or element changes affecting MPS loading or consumption have been provided.

Specific products and processes developed for the FPP by SFOC Program Integration in support of ascent flight design are defined in PDP MS4–002, Flight Systems Analysis.

Products: ET/SSME Heating Environments Data Files and Letter; Complete Ascent Margins Assessment, Degraded RSRM Pre–flight Computer Files; MPS inventory/budget update; Inputs to NSTS 08934, Space Shuttle Operational Data Book; and Flight Specific Requirements Document.

4.4 TRAJECTORY DESIGN DATA PACKAGE

The TDDP has been published using approved baseline documentation.

The TDDPS which define the required Space Shuttle systems and mission content requirements for mission–specific ascent flight design have been published using approved baseline documentation.

Integrated data base systems of current weight and CG for all vehicle elements for all missions baselined in the FDRD are planned, controlled, compiled, and maintained.

Integrated mass property products and maintenance of the data base system have been provided. Additionally, the data base products provide integrated vehicle mass properties at SRB ignition for inclusion in the TDDP. Integrated vehicle mass properties at various entry trajectory points for reporting downweights and CG data have been provided.

Specific products and processes developed for the FPP by SFOC Program Integration in support of ascent trajectory design are defined in PDP MS4–002.

Products: TDDP and Change Notices; Flight Specific Requirements Document; Flight Derived Dispersions Database Update; and ET/SSME Heating Environments Data Files and Letter.

4.5 DOSS ANALYSIS

Required analyses have been performed to update and maintain DOSS.

All analyses required to update and maintain the DOSS configuration and data bases have been performed. The following have been provided to the NASA, load indicator algorithms, flight regime envelope data bases, ET protuberance envelopes, trajectory, loads, and end–to–end dispersions, gust, and wind persistence data bases, data evaluation and problem analysis, independent confirmation and evaluation (audit) of DOSS process, processors, and data bases, a comprehensive data package reflecting the effect of DOL I–Loads on ascent trajectory, and an independent processor to assess the DOLILU I–Load. Data required to support the DOSS activities have been provided and comply with NSTS 08329, Volume VIII.

Specific products and processes developed for the FPP by SFOC Program Integration in support of the DOSS activities are defined in PDP MS4–002.

Products: DOSS Flight–specific Products; DOSS Non–flight–specific Products; and Flight–specific Requirements Document.

4.6 COMPATIBILITY ASSESSMENTS

All compatibility assessments of integrated Shuttle systems, cargo, and mission requirements have been performed.

All assessments and analyses necessary to assure compatibility between the Shuttle and cargo manifest requirements, to verify readiness for all flight phases, to support the Payload Safety Review Panel and integrated safety assessments have been completed. Where discrepancies have been identified, a resolution has been completed. Any environmental impact threat from the manifested cargo have been identified. No outstanding issues remain.

A cargo compatibility analysis for integration of US logistics carriers and integrated US stowage accommodations (stowage racks, trays, etc.) has been performed. Compliance with ISS and SSP safety requirements has been performed and all discrepancies have been resolved.

Mission and Orbiter vehicle compatibility analyses in preparation for flight support have been performed and no discrepancies exist.

Functional compatibility analyses of the DPS hardware, systems software and avionics interfaces, to verify that proper fault tolerance requirements are satisfied and that proper compatibility exist have been performed. The DPS software including Flight Computer Operating System, User Interface, Systems Control Redundancy Management, and Generic Uplink have been evaluated to ensure the proper requirements are identified. In addition, verification has been performed to ensure proper control and performance of the DPS. Technical issues have been identified and resolved, anomalies resolved and problems potentially affecting flight readiness, flight safety, or mission success have been identified and dispositioned for flight.

Additionally, electromagnetic effects, lightning, ionizing radiation, and electrostatic discharge compatibility analysis for all SSV elements, including Orbiter avionics, mid–deck experiments, payloads, and associated interfaces is conducted.

Specific products and processes developed for FPP by SFOC Program Integration for compatibility assessments are defined in PDP MS2–001, Payload/Cargo Structural Analysis; PDP MS2–002, Active and Passive Thermal/ECLSS Verification Analysis; PDP MS2–003, Payload/System Engineering Products EME; PDP MS–002, Element Avionics Systems Integration; PDP MS3–003, Cargo Safety; and PDP MS3–006, System Safety.

Products: Mission–Specific Shuttle Thermal and Structural Math Models; Cargo Thermal and Loads Verification Analysis; Safety Evaluations of Orbiter Services for Payload Use; Payload Environmental Impact Statement; Requirements Updates to SL–E–0001 and SL–E–0002; Element Avionics Interface Databook Updates; Element Avionics Interface Design Review Assessment Reports; and Cargo Compatibility Reports.

4.7 AS–BUILT VERSUS AS–DESIGNED

The as–built configuration has been verified to be in accordance with the approved engineering and program directives.

Tracking and verification of the integrated and flight element processing requirements, systems, flight operations, and ground facilities requirements have been completed. Based on the requirements, the as–built configuration has been verified to be in accordance with the approved engineering and program direction. In addition, a combined element (integrated vehicle) verification is accomplished and all discrepancies have been resolved.

Orbiter turnaround requirements have been evaluated and have been performed during flight operations. All requirements not accomplished have been reported to, and dispositioned by NASA. Accurate Orbiter vehicle configuration requirements and mission kit engineering, implementation procedures, and verification requirements have been provided for the flight. The Orbiter vehicle configuration, mass properties, certification status, and anomaly dispositions have been analyzed to determine whether the requirements for each pending mission have been complied with.

The avionics system verification test requirements which utilize SAIL, Software Reconfiguration Facility, audits, or other appropriate methods have been prepared to assess system compliance with requirements. Verification requirements have been provided for mission verification, new OI testing, SAIL regression testing, Shuttle hardware upgrade verification, SAIL site acceptance, and system integration verification. Mission unique testing includes software patches, DTOs, and general purpose computer memory patches (GMEMS). A summary of open SAIL anomalies and avionics discrepancy reports has been prepared and all issues have been resolved.

Flight configured PASS and BFS software and I–Loads have been verified. The software is properly configured and verified and is ready to be applied to the vehicle to support the flight.

Any maintenance issues are reported to, and dispositioned by the government.

Products: Integration Avionics Verification Test Requirements; SAIL Test Data Requirements Document; and MCPP Red Flag Reports and Concern Flag Reports.

4.8 COMMUNICATIONS AND TELEMETRY REQUIREMENTS

Facility, communications and telemetry requirements for flight operations support activities have been coordinated with NASA and implemented in ground facilities.

The payload and vehicle command and telemetry products needed to reconfigure flight and ground facilities in support of SSP and ISSP missions have been provided.

4.9 ORBITER FERRY REQUIREMENTS

All requirements required to process the Orbiter for ferry have been reviewed and implemented in order to support the ferry readiness.

Processing tasks including the planned and unplanned work performed on the Orbiter, and integration with the government provided SCA in the MDD or other lifting fixtures/ devices required to prepare the vehicle and disposition anomalies for flight have been reviewed. These processing tasks include routine, planned and unplanned processing, and maintenance operations and verification procedures which determine the operational status, and condition of the flight element's systems prior to ferry flight. Also included are the ground support operations performed at intermediate stopovers.

An integrated landing support capability, KSC and DFRC contingency mission support, transatlantic abort site support, payload/ISS element removal efforts, and SRB recovery and disassembly operations are provided. On–site staff at the prime and back–up landing sites to assure arrangements for NASA approved post–landing activities such as crew physicals, crew accommodations, crew clothing, crew transportation, crew guests and other important persons has been provided.

Products: Post–Launch Operations Plan.

4.10 CONTINGENCY REQUIREMENTS

Integrated vehicle contingency operations have been identified and contingency planning has been incorporated.

This planning activity includes planning for natural disasters (i.e., hurricanes); launch delay situations, off nominal landings, major hardware failure safing/recovery situations and crew evacuations.

Integrated Orbiter landing support for unplanned, early mission termination at the primary and secondary landing sites has been assessed. Convoy support at DFRC and White Sands Space Harbor consists of initial Orbiter safing, flight crew egress and towing the Orbiter to the MDD/Orbiter Deservicing area. In addition, contingency mission control center support via the LPS in the KSC Launch Control Center and operational communications support as specified in SSP Emergency MCC Activations and Operations Procedures has been assessed and have been incorporated into documentation.

Products: Post–Launch Operations Plan, for contingency requirements analysis.

5.0 HAZARD ANALYSIS

5.1 SAFETY ISSUE/HAZARD ANALYSIS

All assessments and evaluation of potential safety issues and hazards have been coordinated and all identified issues have been resolved.

Program flight and ground support hardware and software, facilities and facilities systems have been reviewed for safety issues and hazards and issues have been resolved. Testing, ground operations and maintenance activities are assessed for hazards, and all identified issues have been resolved. Waivers, deviations and exceptions have been identified to NASA for approval.

Space Flight Operations has participated in the ALERT System and prepared ALERTs to NASA as required. This includes identification of the affected hardware and analysis of the problem with recommendations and/or corrective actions identification.

All GIDEP ALERTs have been reviewed and there are no outstanding issues.

Specific products and processes developed by SFOC Program Integration to assure program safety are defined in PDP MS3–003, PDP MS3–006, and SFOC–PA–007.

Products: Safety Summary Report.

6.0 ANOMALY RESOLUTION

6.1 ANOMALIES

All anomalies that potentially impact processing, launch, mission success, or landing have been reported and successfully resolved with the NASA.

Prior to each key processing milestone a review of all anomalies is conducted. Any anomalies that potentially impact or constrain that milestone are identified at the key milestone review. Anomalies which potentially impact mission success, represent additional safety risks, impact the program milestone schedule or risks to the government are identified to the NASA and dispositioned prior to continuing with the milestone identified as a constraint. A final review of the anomalies is conducted prior to the project level FRR and dispositioned prior to the SSP FRR. When a resolution cannot be obtained, a CoFR exception is taken.

All anomalies that potentially impact or constrain flight or key processing milestones, and anomalies that represent safety, mission success, major program schedule milestones or risks to the government are identified and resolved.

Specific products and processes developed by SFOC Program Integration to assure resolution of anomalies are defined in PDP MS3–004 and PDP MS3–006.

Products: Completed Risk Assessment Reports; notification of loss of repair; Failure Analysis and Production Facilities and Corrective Action Report; Non–flight Constraint Dispositions; and BFS DR Analysis.

6.2 POST–FLIGHT ASSESSMENT

A post–flight assessment of the actual SSV flight systems performance has been conducted and all discrepancies have been resolved.

A post–flight analysis of the SSV to validate engineering preflight prediction tools and methodologies and to provide the SSP visibility on and resolution of in–flight and anomalous flight history trends has been completed. Issues identified have been dispositioned as acceptable for flight.

Specific products and processes developed for the FPP by SFOC Program Integration for post–flight assessment are defined in PDP MS4–002.

6.3 OUT–OF–FAMILY PROBLEM RESOLUTION

Approval has been obtained from NASA for all out–of–family dispositions (reference NSTS 08126, Appendix B for definition of out–of–family).

Any out–of–family anomaly is identified to the responsible NASA prior to implementation of corrective action. The anomaly is dispositioned prior to the milestone constraint identified and disposition is provided to NASA. Prior to the SSP FRR, all out–of–family anomaly dispositions are approved by the Government.

Products: All out–of–family issues dispositioned prior to launch.

7.0 SFOC PRE–FRR

7.1 SUBCONTRACTOR REVIEWS

Element subcontractors have technically concurred with the processing and the hardware requirements and have certified that the individual elements are safe to fly.

Products: Flight Readiness Statements.

7.2 PROCESS REVIEWS

Post–launch activities have been assessed, readiness reviews conducted, and all issues identified.

Integrated landing support capability, support for KSC and DFRC contingency mission support, transatlantic abort site support, payload/ISS element removal efforts, and SRB recovery and disassembly operations have been assessed. When required, readiness reviews have been conducted. The retrieval ship crew has been trained and certified, and the ships are prepared to be on station to support post–launch activities. Planned and unplanned Orbiter landing operation, including site readiness preparations and post–landing operations at the Primary Landing Site, Secondary Landing Site, Contingency Landing Site locations, and TAL sites under the direction of the NASA landing team has been assessed and is ready to support the post–launch activities. As a minimum, these efforts include the integration of efforts to recover and tow the Orbiter to either the OPF or the DFRC MDD; payload element destow/early access operations; Return to Launch Site convoy support; and, transportation of equipment, material, rentals, and freight to these sites.

Retrieval and recovery operations on the spent boosters, parachutes and frustums from the Atlantic Ocean and transport to the Cape Canaveral Air Station Hanger AF have been evaluated. All changes to the procedures have been documented and a pre–test briefing will be conducted prior to retrieval and disassembly. Once the boosters arrive at Hanger AF, they will be safed and disassembled, post–flight inspections will be conducted, and all anomalies will be documented prior to shipment of the hardware.

7.3 FRR READINESS

A project level Pre–FRR has been conducted.

SFOC will hold a Pre–FRR which will be composed of the SFOC Board, the APMs and their supporting organizations.

Prior to coming to the SFOC Board Review, a review will be conducted by the APM and their NASA counterpart. This review will address the subcontractor and SFOC FRR readiness in depth. Once these reviews are completed, the primary topics of concern will be consolidated and presented to the SFOC Board by the organization having the primary responsibility. The SFOC Board Briefing assembly and topic consolidation responsibility will lie with SFOC Program Integration.

For those functions under their responsibility areas, the SFOC APMs will be responsible for resolution of all issues/problems, safety issues, identification of all constraints, waiver/exceptions, documented requirements/analyses/test results, and certification/verification of all hardware, software and people, etc.

Upon completion of the SFOC, Pre–FRR subjects will be selected for presentation to the FRR. SFOC will present an integrated briefing to the FRR Board.

Products: Flight Readiness Statements and CoFR Endorsements.

APPENDIX S

SPACE SHUTTLE PROGRAM SAFETY AND MISSION ASSURANCE FLIGHT PREPARATION PROCESS PLAN

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CONTENTS

NSTS 08117

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APPENDIX S

SPACE SHUTTLE PROGRAM SAFETY AND MISSION ASSURANCE FLIGHT PREPARATION PROCESS PLAN

1.0 PURPOSE

This appendix describes the processes and products that SSP S&MA will review by audit, insight and surveillance on to ensure the compliance with Space Shuttle missions.

2.0 RESPONSIBILITIES

The following sections identify the areas under the purview of the SSP S&MA to perform audit, insight, and surveillance on for flight.

2.1 SAFETY

Audits of the contractor are performed to ensure the contractor has identified, eliminated (when necessary), and reviewed compliance with hazards throughout the flight preparation process. All out–of–family issues identified are properly dispositioned.

2.2 RELIABILITY AND MAINTAINABILITY

Surveillance is performed to ensure the contractor has developed and implemented program reliability and maintainability policies. Surveillance is performed to ensure the contractor has identified all reliability and maintainability performance issues against baseline allocations including preparation, maintenance, and control of reliability assessments such as FMEAs and assessments of materials and parts in support of operational integrity. Issues with reliability assessments issues including critical items and operational impacts of hardware failure modes have been identified. All out–of–family issues identified are properly dispositioned.

2.3 QUALITY

Surveillance is performed of selected products, processes and services to ensure the contractor is compliant with program policies. Surveillance is performed to ensure the nonconformances, problems, and failure analysis are identified and properly dispositioned for flight. Processing problems identified have had corrective action taken which modifies processes procedurally or otherwise to prohibit further noncompliance. All out–of–family issues identified are properly dispositioned.

2.4 RISK MANAGEMENT

Surveillance is performed to ensure safety, reliability, maintainability and quality issues are correlated with mission success probabilities. Issues brought to program management have had a risk assessment which addressed the assurance issues (safety, reliability, maintainability, and quality). All out–of–family issues identified are properly dispositioned.